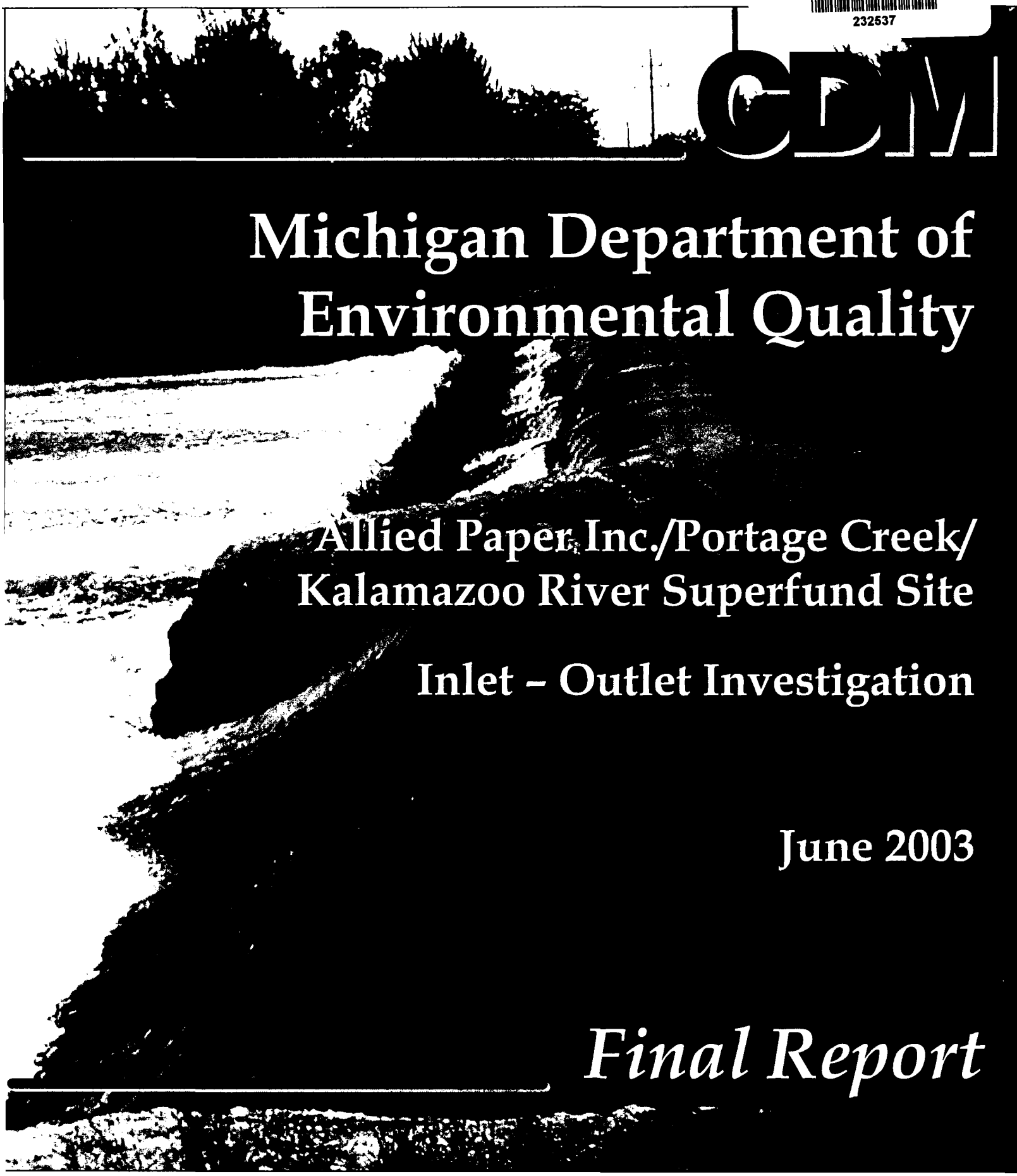


CDM

Michigan Department of Environmental Quality

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Inlet – Outlet Investigation

June 2003

Final Report

Contents

Section 1
Introduction

In 1998, the Michigan Department of Environmental Quality (MDEQ) requested that Camp Dresser & McKee (CDM) design and execute a long-term monitoring (LTM) program for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Site) in southwest Michigan. A small component of the LTM program was to gather information about the magnitude and distribution of polychlorinated biphenyl (PCB) contamination in Lake Allegan (Figure 1-1 below), namely if the lake acted as a sink or a source of PCBs to the Phase II portion of the river, from below Lake Allegan to the mouth of the Kalamazoo River where it enters Lake Michigan. A preliminary study was performed at Lake Allegan in September 1999, which is further detailed in Section 3.1.2 of the 1999 LTM Report (CDM 1999).

Figure 1-1. Lake Allegan Dam Separating Phase I and II of the API/KR/PC Superfund Site.

In April 2001, based on the results of the 1999 LTM sampling, an additional inlet / outlet (IO) study was implemented. The purpose of this study is to evaluate PCB concentrations in surface water entering and exiting Morrow Lake, located upstream of the Site (Figure 1-2), and Lake Allegan. PCB concentrations were evaluated to determine how these lakes contribute to the transport of PCBs within the Kalamazoo River system.

Figure 1-2. Morrow Lake Upstream of the API/KR/PC Superfund Site.

The objectives of this study are:

- To evaluate if Morrow Lake and/or Lake Allegan can be classified as PCB sources (contributing PCB to the surface water column) or sinks (where PCB settles out of the surface water column) to the Kalamazoo River.
- To establish a baseline range of seasonal and temporal variation in surface water PCB concentrations.
- To evaluate if correlations exist between surface water PCB concentrations, suspended sediment, and seasonal conditions (water temperature and flow).
- To evaluate if there are patterns of PCB congener degradation.

Surface water sampling was conducted on a monthly basis for one year (May 2001 to April 2002) at inlet and outlet locations of Morrow Lake and Lake Allegan. After one full year of data collection and evaluation, MDEQ authorized continued monthly sampling through October 2002. A total of eighteen monthly sampling surveys were conducted from May 2001 through October 2002.

Sampling activities included collecting surface water samples for analysis of PCB congeners and total suspended solids (TSS), and recording water temperature of each sample. Although flow rate data were collected from United States Geological Service (USGS) stream gages, sampling surveys were conducted during a single day of the second full week of each month, regardless of river flow conditions. Sampling was conducted in accordance to the protocols and stations established for the Baseline LTM Program (CDM 2001b).

This report documents results from sampling conducted from May 2001 to October 2002, and discusses future plans for this study. Results from this study may be used to supplement samples collected as part of the Baseline LTM program and will be helpful in refining future monitoring efforts within the study area.

Section 2
Methodology and Rationale

2.1 Sampling Location Selection

In order to effectively "bracket" Morrow Lake and Lake Allegan, sampling stations were selected based on the proximity and accessibility of the inlet and outlet compared to the main water body. An additional consideration in sample location selection was whether the station had been previously used for surface water sampling. Figure 2-1 in Appendix A shows the stations sampled during the IO Study. The Morrow Lake inlet station (012) is located along the 35th Street Bridge just upstream of the mouth of the Lake. The outlet station (013) was located along the River Road Bridge, which is approximately 1.2 miles downstream of Morrow Lake Dam. Accessibility problems precluded the sampling station from being placed closer to the dam. The Lake Allegan inlet station (027) is located along M-89 Bridge just upstream of the mouth of the Lake. These three stations were established and sampled prior to the IO Study as part of the Baseline LTM Program. The Lake Allegan outlet station (071), located at the west end of Lake Allegan was added in 2001 after Consumers Powers Company granted MDEQ and CDM permission to sample from upstream side of the Lake Allegan Dam.

2.2 Sample Collection Methods

The sample collection methods used for the IO Study are in accordance with the standard operating procedure documents for dry and wet weather surface water sampling as described in Appendix A of the 2001 LTM Plan (CDM 2001b)

On the second full week (defined as Monday through Friday) of every month, regardless of flow condition, surface water samples were collected on one day at the designated inlet and outlet sampling stations.

Surface water samples were collected in 1-liter amber glass sample bottles for PCBs and 500 milliliter plastic bottles for TSS. The bottles were lowered into the surface water using a metal harness attached to a rope (Figure 2-2 below), and raised up and down through the water column to collect a depth-integrated sample. Water temperature of each sample was recorded in the field using a standard laboratory thermometer attached to the sampling apparatus. Samples were stored on ice in the field or at 4° C until extraction by Northeast Analytical (NEA) Labs.

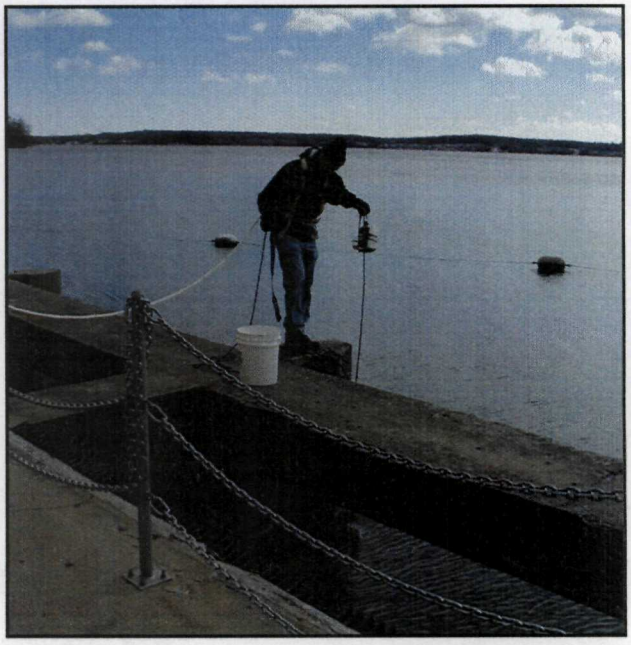


Figure 2-2. Sampling at the Lake Allegan Outlet Station Off Lake Allegan Dam

Water samples were collected during various Kalamazoo River flow regimes, ranging from a minimum of 433 cubic feet per second (cfs) to a maximum of 2340 cfs recorded at the USGS 04106000 Kalamazoo River at Comstock gage as shown in Figure 2-3 of Appendix A.

2.3 Sample Analysis Methods

Surface water samples were analyzed for congener-specific PCBs by modified EPA Method 8082. This approach has a much lower method detection limit (2 ng/L) compared to Aroclor analysis. Since sediment is continuously entrained in and deposited from the water column, surface water samples were also analyzed for TSS by EPA Method 160.2. Laboratory data sheet results for congener-specific PCB results are contained in Appendix C.

2.4 Sample Variability

In accordance with Appendix A of the 2001 LTM Plan (CDM 2001b), three samples were collected from along a transect at each station. Evaluation of initial surface water sampling event data collected at the Site indicates a range of results between water samples. Specifically, those collected from a near-bank location may be different from other near-bank or mid-channel locations.

The difference between the samples, or data heterogeneity, was assessed by calculating a relative standard deviation (RSD) value, as follows:

RSD = (Standard Deviation/Mean) X 100

RSD is a statistical measure used to evaluate how well results collected from the same sampling location agree with one another, relative to the average of the data.

2.5 Quality Assurance / Quality Control, and Data Validation

The project specific quality assurance (QA) objectives for the IO monitoring are similar to those described in Section 4.4 of the 2001 LTM Plan (CDM 2001b). Consistent with this plan, field quality control (QC) samples were collected to evaluate precision and accuracy. For IO water samples, field duplicates were collected at a frequency of one per survey. The relative percent difference (RPD) for field duplicates was considered acceptable if it was less than 25%.

Additionally, matrix spike/matrix spike duplicates (MS/MSD) and field blanks or equipment/rinsate blanks were collected at a frequency of one per survey.

The laboratory QC criteria are defined below. Laboratory check standards were required to fall within 15% of the true value of the standard to be considered in control or to meet the QC criteria. Laboratory blank samples that have a mean total PCB concentration greater than the practical quantitation limit (PQL) were reviewed to determine if the concentration of any individual congener exceeded the PQL. Data were qualified for blank contamination if individual Aroclors or congeners exceeded the PQL. This same evaluation was performed for field blank samples and data qualification being required only if individual congeners in the field blank exceed the PQL. Matrix spike and matrix spike duplicate sample recoveries were required to fall within the range of 60% to 140% of the true spiked value. The agreement between MS and the MSD were required to be within 25% relative percent difference to be considered in control. The first laboratory surrogate was required to have a surrogate recovery within the range of 60% to 140% and if it did not meet that criteria, an additional surrogate analysis would be performed which would then need to fall within those control limits.

Discussions of the QA/QC results with respect to the QA/QC objectives are presented in Sections 3.2 and 3.3.

Section 3
Results and Discussion

The data presented in this report were collected from May 2001 through October 2002 during eighteen sampling surveys. Total PCB concentrations were calculated as the summation of the individual congeners. Mean total PCB and TSS concentrations were calculated by averaging the total results from three samples (left bank, mid-channel, right bank) that were collected along a transect at each station.

3.1 Surface Water Analytical Results

Surface water was collected during single-day sampling events, once a month from May 2001 through October 2002 for a total of eighteen sampling surveys. Sampling surveys were conducted at the inlet and outlet of Morrow Lake (stations 012 and 013) and Lake Allegan (stations 027 and 071). The analytical results for PCB and TSS concentrations are graphically depicted in Figures 3-1 through 3-4, and are summarized in Tables 3-1 to 3-8 located in Appendix B.

The mean daily flow for the USGS 04106000 Kalamazoo River at Comstock gage (located downstream of Morrow Lake), USGS 04107850 Kalamazoo River near Allegan (upstream of Lake Allegan), and the reported Consumers Energy flow data (Lake Allegan Dam outlet flow) are included in Table 3-9 of Appendix B.

Figures 3-5 to 3-12 of Appendix A and Table 3-10 in Appendix B present data correlations between PCB and TSS concentrations, flow, and surface water temperature. Flow was observed to steadily increase through the fall and winter months, peak in the spring, and then dip near the end of summer. These flows were used to calculate an estimate of PCB loadings into Morrow Lake and Lake Allegan. Table 3-11 of Appendix B presents this data. Water temperature generally increases in the spring, peaks in the summer, decreases in the fall, and dips in the winter.

3.1.1 Morrow Lake

PCB Concentrations

Figure 3-1 in Appendix A and Tables 3-1 and 3-3 in Appendix B show mean total PCB concentrations in surface water for Morrow Lake inlet ranged from 0.17 to 3.61 ng/L, while outlet mean total PCB concentrations ranged from 0.18 to 3.65 ng/L. There is not a statistically significant difference in the inlet and outlet PCB concentration sample means for each event using Student's t-test with $p = 0.05$. These concentration ranges are consistent with surface water collected under the LTM Program upstream of Morrow Lake at Ceresco Reservoir. During five dry weather sampling events from 1999 to 2000 [as presented in the 1999 and 2000 Long Term Monitoring reports (CDM 2001a and 2002)], Ceresco Reservoir mean total PCB concentrations ranged from 0.51 to 5.01 ng/L, which is slightly higher than the PCB concentrations recorded at inlet and outlet sampling stations at Morrow Lake.

Figure 3-7 in Appendix A presents the inlet and outlet mean total PCB concentrations, with flow data from the USGS 04106000 Kalamazoo River at Comstock gage. Figure 3-7 shows that when flows were decreasing in 2001 and 2002 (May through August-September), the inlet mean total PCB concentrations tended to be slightly less than outlet. When flows increased (September through April), inlet mean total PCB concentrations were less than outlet for three surveys and greater than outlet for three surveys. Based on these results, it appears that mean total PCB concentrations at Morrow Lake inlet and outlet are not strongly correlated with flow.

Figure 3-11 in Appendix A presents the inlet and outlet mean total PCB concentrations versus surface water temperature. The figure shows no apparent correlation between PCB concentration and surface water temperature, e.g. increasing PCBs with increasing temperature. Comparing mean total PCB concentrations by paired month and year surveys (e.g. June 2001 and June 2002) for May through October, Figure 3-11 does show consistent patterns between the inlet and outlet. For example, mean total PCB concentrations in June 2001 and June 2002 show that the outlet (1.31 and 3.60 ng/L) is slightly greater than inlet (0.53 and 2.77 ng/L); for October 2001 and October 2002, the inlet (1.30 and 3.06 ng/L) is slightly greater than the outlet (0.84 and 2.09 ng/L).

From Table 3-10 in Appendix B, mean total PCB concentrations for the inlet are slightly greater than the outlet in the winter (2.92 versus 2.67 ng/L) and spring (1.02 versus 0.43 ng/L) seasons, and are slightly less than the outlet in the summer (1.32 versus 1.75 ng/L) and fall (1.37 versus 1.87 ng/L) seasons. On average, mean total PCB concentrations appear to increase slightly from spring to fall, with the highest observed mean total PCB concentrations in the winter (2.92 and 2.67 ng/L, respectively).

PCB loadings were estimated by multiplying an instantaneous flow value from the USGS 04106000 Kalamazoo River at Comstock gage by the mean total PCB concentration at the inlet and outlet stations. The results are presented in Table 3-11 in Appendix B. On average, the PCB loading for the inlet is similar to the outlet, indicating that Morrow Lake is not acting as a significant net source of PCBs to downstream areas.

TSS Concentrations

Figure 3-2 in Appendix A and Tables 3-2 and 3-4 in Appendix B show that mean total TSS concentrations in surface water for Morrow Lake inlet ranged from 1.8 to 137 mg/L compared to the outlet from 3.0 to 17.33 mg/L. The 137 mg/L outlier was from the July 10, 2002 sampling event that had one near-bank sample with 370 mg/L. This outlier is most probably attributable to sample collection that caused localized excess turbidity in the water column.

Figure 3-5 in Appendix A presents mean total PCB concentrations versus mean TSS concentrations. The figure shows that elevated TSS concentrations do not consistently correlate to an increase in mean total PCB concentrations for either the inlet or outlet. Table 3-10 in Appendix B shows TSS at the inlet are on average higher than the outlet (except for the fall), possibly indicating solids deposition in Morrow Lake. Additionally, higher TSS concentrations on average were observed in the spring and summer compared to the fall and winter seasons. This observation could be due to a number of factors including bioturbation, water sports recreations, or runoff from construction areas.

Figure 3-9 in Appendix A presents mean TSS concentrations versus flow at the USGS 04106000 Kalamazoo River at Comstock gage. The figure shows that a rise river flow does not correlate to an increase in TSS concentrations for either the inlet or outlet.

- ***Based on the IO dataset, Morrow Lake cannot be classified as either a PCB source or sink.***

3.1.2 Lake Allegan

PCB Concentrations

Figure 3-3 in Appendix A and Tables 3-5 and 3-7 in Appendix B show mean total PCB concentrations in surface water for Lake Allegan inlet ranged from 1.38 to 27.73 ng/L compared to the outlet from 1.17 to 14.92 ng/L.

Figure 3-8 in Appendix A presents the inlet and outlet mean total PCB concentrations versus

flow at the USGS 04106000 Kalamazoo River at Comstock gage. Figure 3-8 shows that when flows were decreasing in the late spring to summer 2001 and 2002 (May through August), outlet mean total PCB concentrations stay consistently lower than inlet concentrations. In these lower flow conditions, PCBs may be settling out of the water column. There were no patterns observed when flows tend to increase during fall to spring.

Table 3-10 in Appendix B shows that, on average, the two highest flow seasons (spring and winter) were associated with the two lowest PCB results. Consequently, it appears that mean total PCB concentrations at the Lake Allegan inlet and outlet are not positively correlated with flow.

Figure 3-12 in Appendix A presents the inlet and outlet mean total PCB concentrations versus surface water temperature. The data suggest a correlation between PCB concentration at the inlet and surface water temperature (increasing PCBs with increasing temperature; and, decreasing PCBs with decreasing temperature). Figure 3-12 also indicates that the mean total PCB concentrations for the inlet are greater than the outlet when water temperatures are higher. Additionally, the difference between the inlet mean total PCB concentration and the outlet increases as water temperature increases and decreases with decreasing temperature. From Table 3-10 in Appendix B, mean total PCB concentrations for the inlet are significantly greater than the outlet in the summer and fall seasons, slightly greater in the spring, and less in the winter.

PCB loadings were estimated by multiplying an instantaneous flow value from the USGS 04107850 Kalamazoo River near Allegan gage by the mean total PCB concentration at the inlet and outlet stations. The results are presented in Table 3-11 in Appendix B. On average, the PCB loading for the inlet appears to be approximately six times greater than that of the outlet. This indicates that Lake Allegan acts as a PCB sink to upstream areas and a source to downstream areas.

TSS Concentrations

Figure 3-4 in Appendix A and Tables 3-6 and 3-8 in Appendix B show mean total TSS concentrations in surface water for Lake Allegan inlet ranged from 4.47 to 45.97 mg/L, and from 3.8 to 56.67 mg/L at the outlet.

Figure 3-6 in Appendix A presents mean total PCB concentrations versus mean TSS concentrations. Except for one mean data point in May 2002, the inlet TSS were observed to be greater than the outlet. The single outlying data point is possibly attributable to increased localized turbidity from sample collection. The figure shows that elevated TSS concentrations do not correlate to an increase in mean total PCB concentrations for the inlet. However, mean total PCB concentrations and mean TSS concentrations for the outlet do appear to follow the same pattern (e.g. increased PCB and TSS). Table 3-10 in Appendix B shows TSS at the inlet are on average higher than the outlet, possibly indicating solids deposition in Lake Allegan. Additionally, higher TSS concentrations, on average, were observed in the spring, summer, and fall compared to the winter season. Again, this observation could be due to a number of factors including bioturbation, water sports recreations, or runoff from construction areas.

Figure 3-10 presents mean TSS concentrations versus flow at the USGS 04106000 Kalamazoo River at Comstock gage. The data shows that a rise in river flow does not correlate to an increase in TSS concentrations for either the inlet or outlet.

- ***Based on the IO dataset, Lake Allegan can be classified as a PCB sink for***

surface water from upstream areas and a PCB source to downstream areas.

3.1.3 Congener-Specific Evaluation

The 209 theoretically possible individual PCB congeners can be organized by the number of chlorine atoms on the biphenyl molecule into 10 groups called homolog groups. For example, the monochlorobiphenyl homolog group includes all the PCB congeners with one chlorine atom on the biphenyl molecule, and is typically referred to as homolog group number 1. Data for homolog groups can provide a "first cut" assessment of the environmental behavior of the many congeners that occur in a typical study area

Figure 3-13 and Figure 3-14 in Appendix A show homolog data from Morrow Lake and Lake Allegan, respectively, as the difference between the outlet and inlet. This is expressed as chemical weight of each PCB congener, a mole percentage.

Figure 3-13 shows that homolog data from September 2001 and December 2001 through February 2002 indicate that the lighter dichlorobiphenyls and trichlorobiphenyls decrease from the inlet to outlet while heavier tetracholorbiphenyls, pentachlorobiphenyls, and hexachlorobiphenyls increase. This may be due to volatilization, however, the observation occurs during fall-winter months, which likely have the lowest volatilization rates. Figure 3-13 also shows months where heavier homologs are decreasing from the inlet to outlet, while lighter homologs are increasing. This observation may be due to heavier PCB congeners settling out before reaching Lake Allegan Dam or PCB biodegradation could be occurring within the Lake. No consistent PCB homolog patterns or seasonal variations were observed.

Figure 3-14 shows a noticeable pattern of PCB homolog data where the heavier homologs appear to be decreasing from inlet to outlet, while the lighter homologs are increasing from inlet to outlet. Again, this observation may be due to heavier PCB congeners settling out before reaching Lake Allegan Dam, or PCB biodegradation occurring within the Lake. There does not appear to be any seasonal variations in homolog data.

3.2 Summary of Field QC

Based on a review of the analytical data, field duplicates were collected at the prescribed frequency for the monthly IO sampling surveys between May 2001 and October 2002 with the exception of November 2001 when no field duplicate was collected. The relative percent difference (RPD) between field samples and field duplicates varied greatly for all the sampling surveys. Approximately half of the sampling surveys had field duplicate RPDs above the 25% guideline. As previously mentioned, an RPD of 25% is the guideline for acceptable agreement between field sample and field duplicate. However, because there are so many factors that influence the RPD of field duplicate samples, the data are not qualified based on an exceedance of the 25% RPD guideline. In general, when RPDs were high, greater than 100%, it was because of non-detect samples being compared with very low concentration field duplicates or due to low total PCB concentrations in the sample or the duplicate. The higher concentration IO water samples showed better agreement for field duplicates.

Matrix spike and matrix spike duplicate (MS/MSD) sample collection conformed to the prescribed frequency of one per monthly IO sampling survey for all surveys from May 2001 to September 2002. Field rinsate blank collection also conformed to the prescribed frequency. Based on the review of the field blank data for the IO sampling, 14 surveys out of the 18 surveys had detections of PCB congeners in the field blanks at levels greater than the MDL but less than the PQL. These PCB detections did not result in data

qualification for the monthly sampling surveys. It is recommended however that field personnel ensure that they are using ultra-pure or laboratory reagent grade distilled water for all future sampling surveys.

3.3 Summary of Laboratory QC

A summary of the laboratory QC is presented in Table 3-12 of Appendix B. Table 3-12 indicates that all the data collected during the IO Study met QC criteria as defined in Section 2.5. The table also shows that even though some field duplicates were outside the control criteria and some samples were re-analyzed due to laboratory contamination, no data were qualified based on these deviations. As a result, all data presented in this report are usable as reported by the laboratory.

Section 4
Conclusions and Recommendations

From May 2001 through October 2002, MDEQ and CDM implemented an IO Study to evaluate PCB concentrations in surface water at Morrow Lake and Lake Allegan. Surface water samples were collected from the inlet and outlet of each water body to evaluate how these lakes contribute to the transport of PCBs within the Kalamazoo River system. Data collected as part of this study indicate:

- Morrow Lake cannot be distinguished as a PCB source or a sink to the Kalamazoo River, as the same quantity of PCB in the water column enters and exits Morrow Lake. However, Lake Allegan appears to act as a PCB sink for upstream areas and a PCB source, an average of 0.015 lbs/day, to areas further downstream.

- In Lake Allegan, PCB concentrations in surface water are strongly correlated with surface water temperature; i.e., higher PCB concentrations are associated with higher water temperatures. The maximum warm water PCB concentrations are about a factor of ten above the minimum cold water PCB concentrations. PCB concentrations do not correlate well with flow or TSS concentrations.

- The dataset may be helpful in evaluating future trends in PCB concentrations for pre- and post-remedial monitoring.

- PCB congener-specific data did exhibit some patterns of degradation and/or accumulation, however, conclusions as to the mechanism involved (biodegradation, volatilization, deposition) can not be drawn based on this dataset. An examination of the likely contribution of each mechanism would require the comparison of model results with the analytical data.

The following activities are proposed for the IO Study in 2003 and 2004.

- Surface water samples will be collected on a quarterly basis, rather than monthly. Sample locations will continue to include the inlet and outlet of Morrow Lake, Lake Allegan, and also from the inlet and outlet of the Plainwell and Otsego City Impoundments. In addition, samples will be collected from a location in the lower reaches of the Kalamazoo River (Phase II) near Kalamazoo Lake. Sampling on a quarterly basis rather than monthly, will be sufficient to evaluate seasonal trends in PCB concentrations. The data collected from this IO sampling program can also be used as a pre- and post-remediation monitoring for the Plainwell and Otsego City Impoundments.

Section 5
References Cited

Camp Dresser & McKee. 2002. Final Report on the Allied Paper, Inc /Portage Creek/Kalamazoo River Superfund Site Long-Term Monitoring Program: Results from the 2000 Field Season. (CDM 2002)

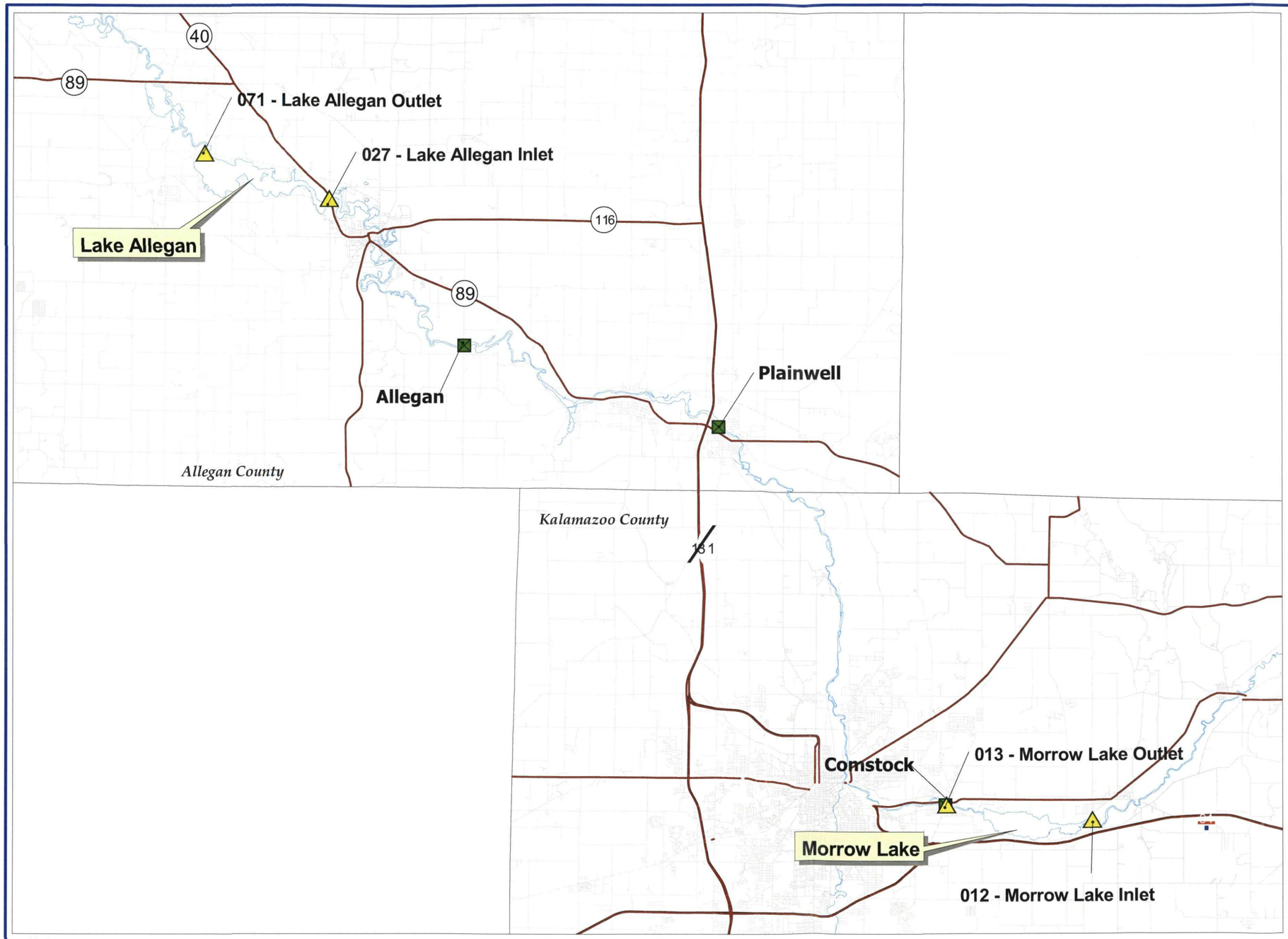
Camp Dresser & McKee. 2001. Final Report on the Allied Paper, Inc /Portage Creek/Kalamazoo River Superfund Site Long-Term Monitoring Program: Results from the 1999 Field Season. (CDM 2001a)

Camp Dresser & McKee. 2001. Long Term Monitoring Plan - Allied Paper, Inc/Portage Creek/Kalamazoo River Superfund Site. (CDM 2001b)

Camp Dresser & McKee. 1999. Long Term Monitoring Plan - Allied Paper, Inc/Portage Creek/Kalamazoo River Superfund Site. (CDM 1999)

Appendix A - Figures

Appendix A – Figures (continued)



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LEGEND

- Surface Water Sample Location
- USGS Stream Gauge
- Kalamazoo River/Portage Creek
- Highways
- Local Roads

2 0 2 4 Miles

Notes:
(1) Aerial photographs taken by Air Land Surveys, Inc. on 4/24/00.
(2) Coordinates are in State Plane Michigan South NAD 1983.

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CDM

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Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Inlet - Outlet Study
Surface Water Sample Locations

Figure No. 2-1

Figure 2-3. Kalamazoo River Flow Rates from May 2001 to October 2002 During Eighteen Inlet - Outlet Sampling Surveys

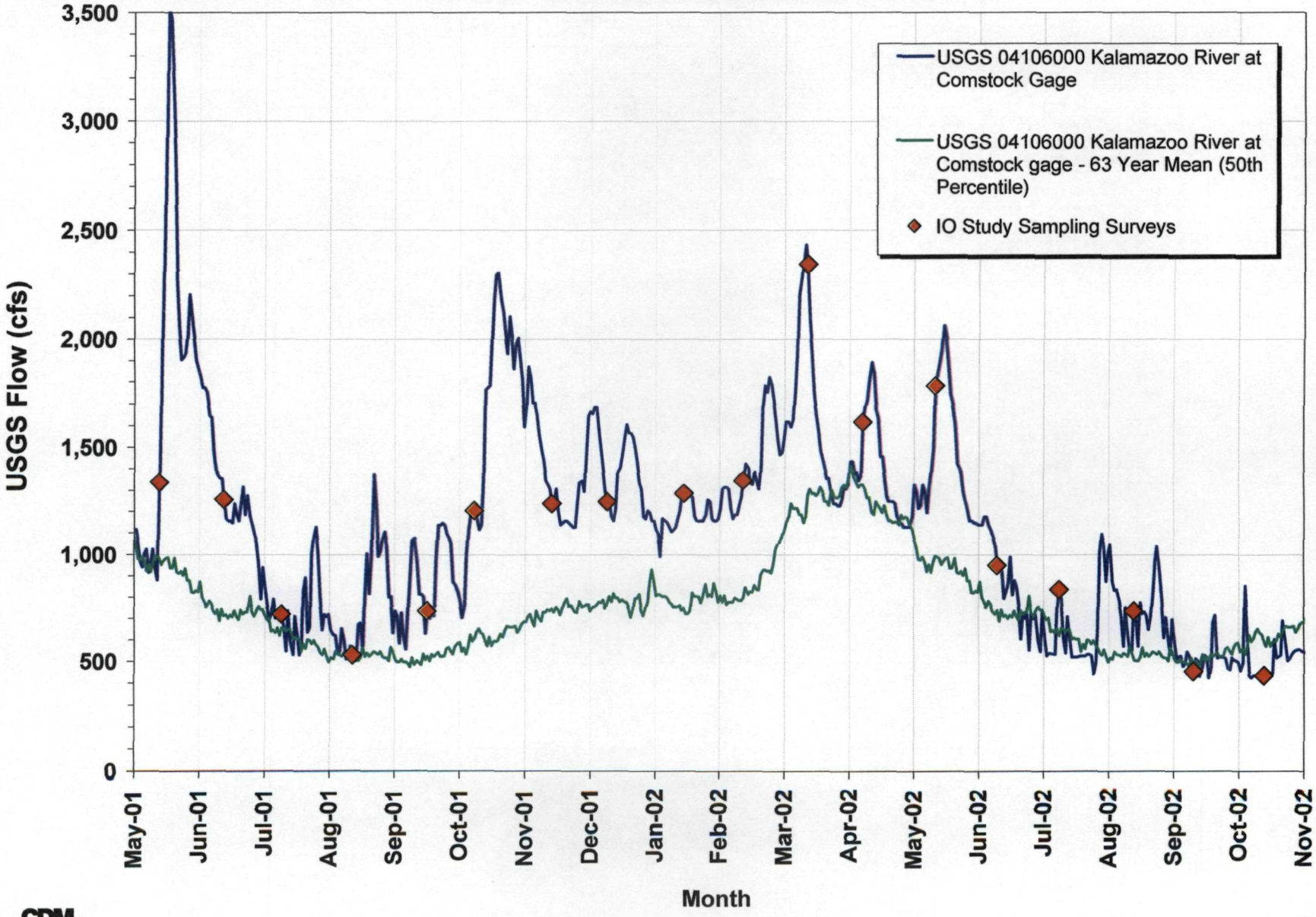

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Figure 3-1. Total and Mean Total PCB Concentrations
Morrow Lake Inlet - Outlet Stations
May 2001 through October 2002

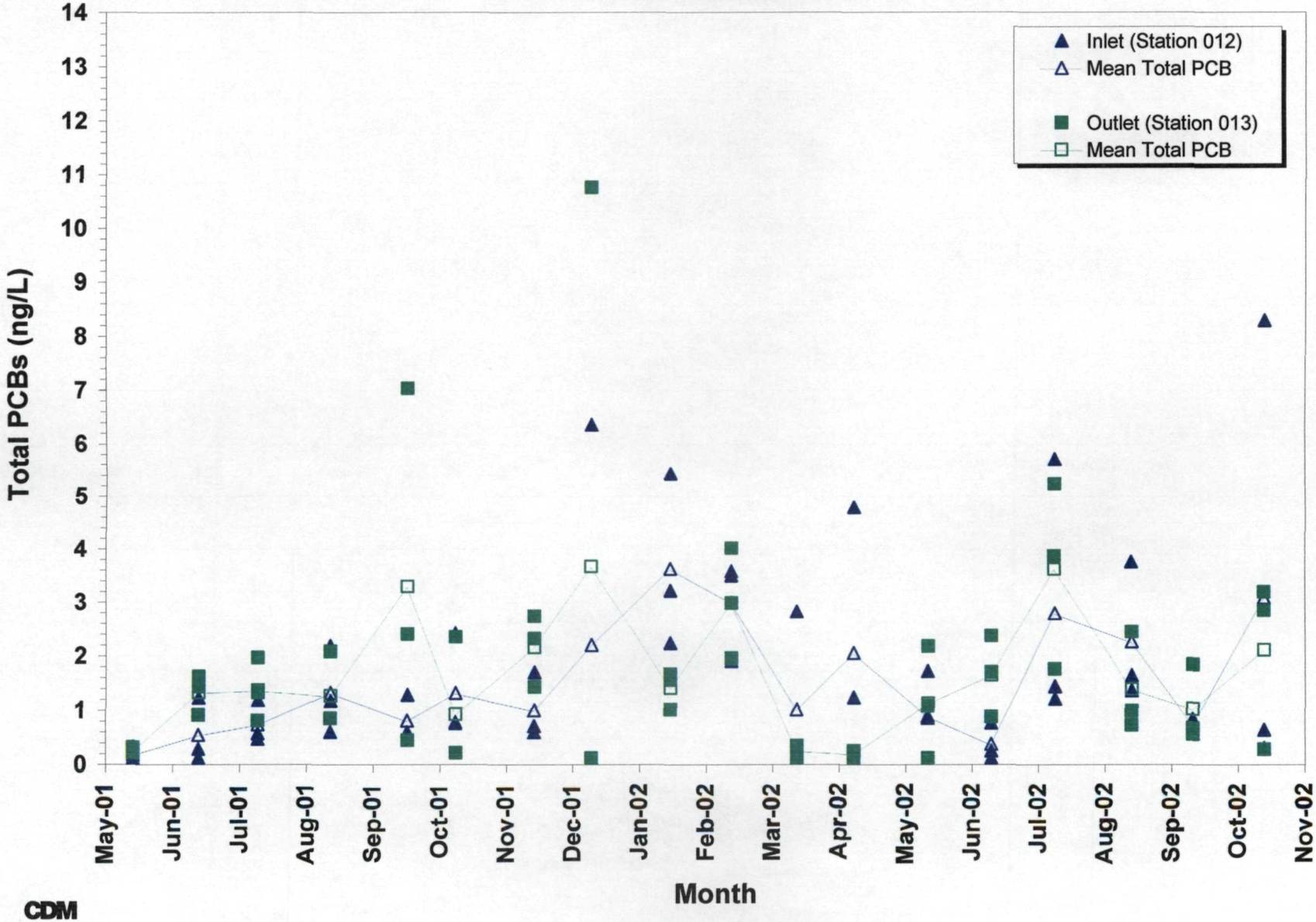

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Figure 3-2. Total and Mean Total TSS Concentrations
Morrow Lake Inlet - Outlet Stations
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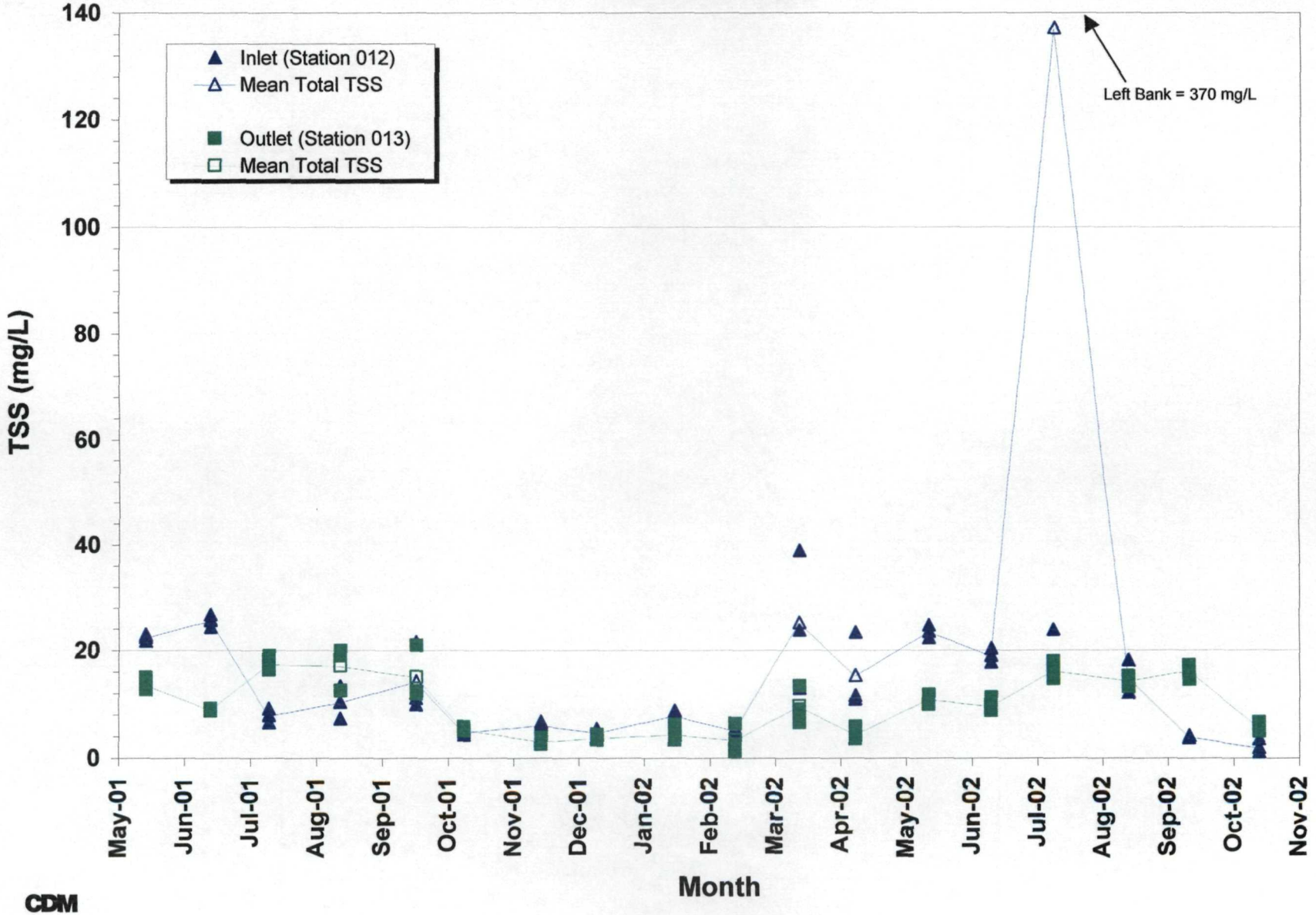

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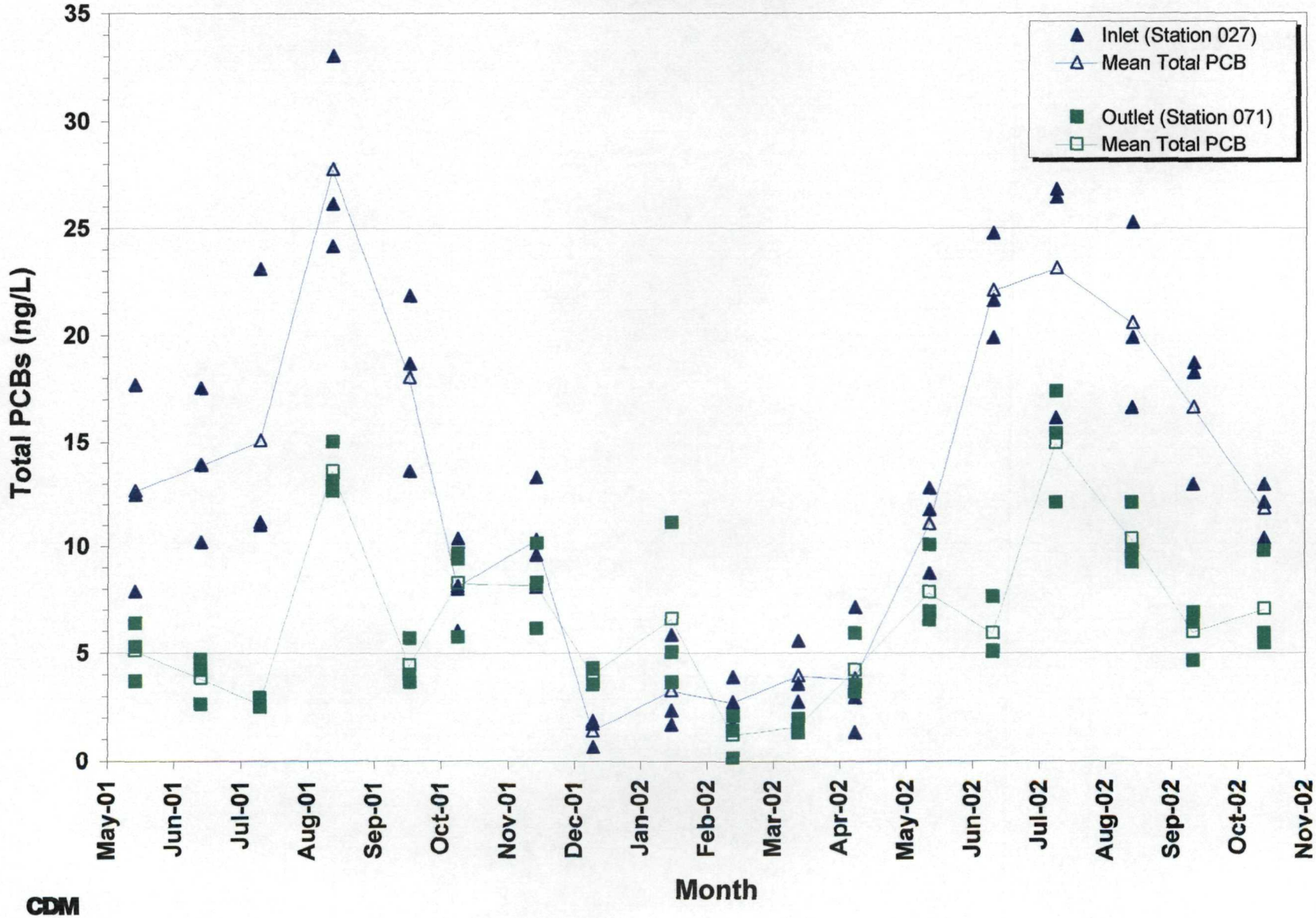
Figure 3-3. Total and Mean Total PCB Concentrations
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



CDM

Figure 3-4. Total and Mean Total TSS Concentrations
Lake Allegan Inlet - Outlet Stations
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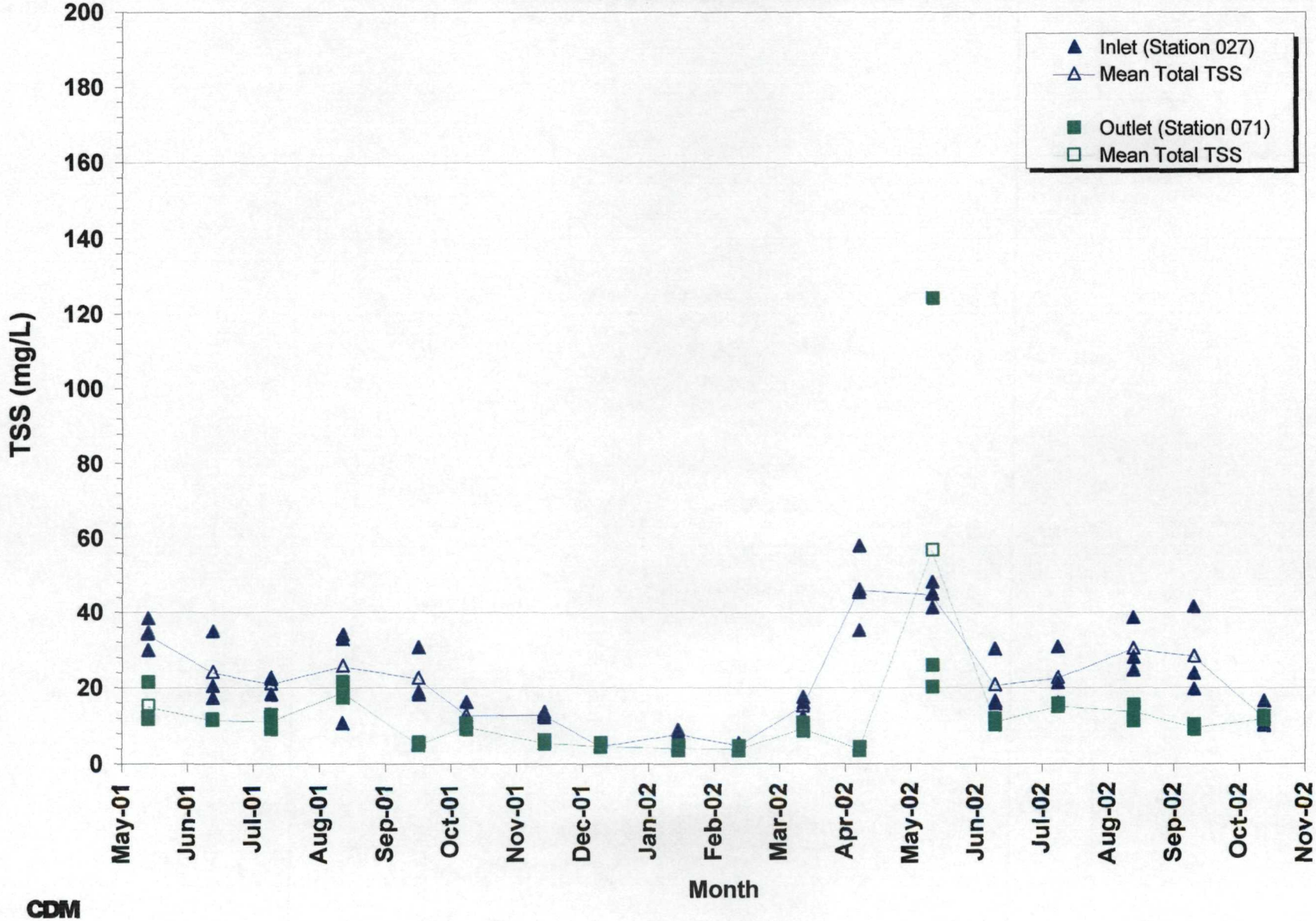

CDM

Figure 3-5. Mean Total PCB and Mean Total TSS Concentrations
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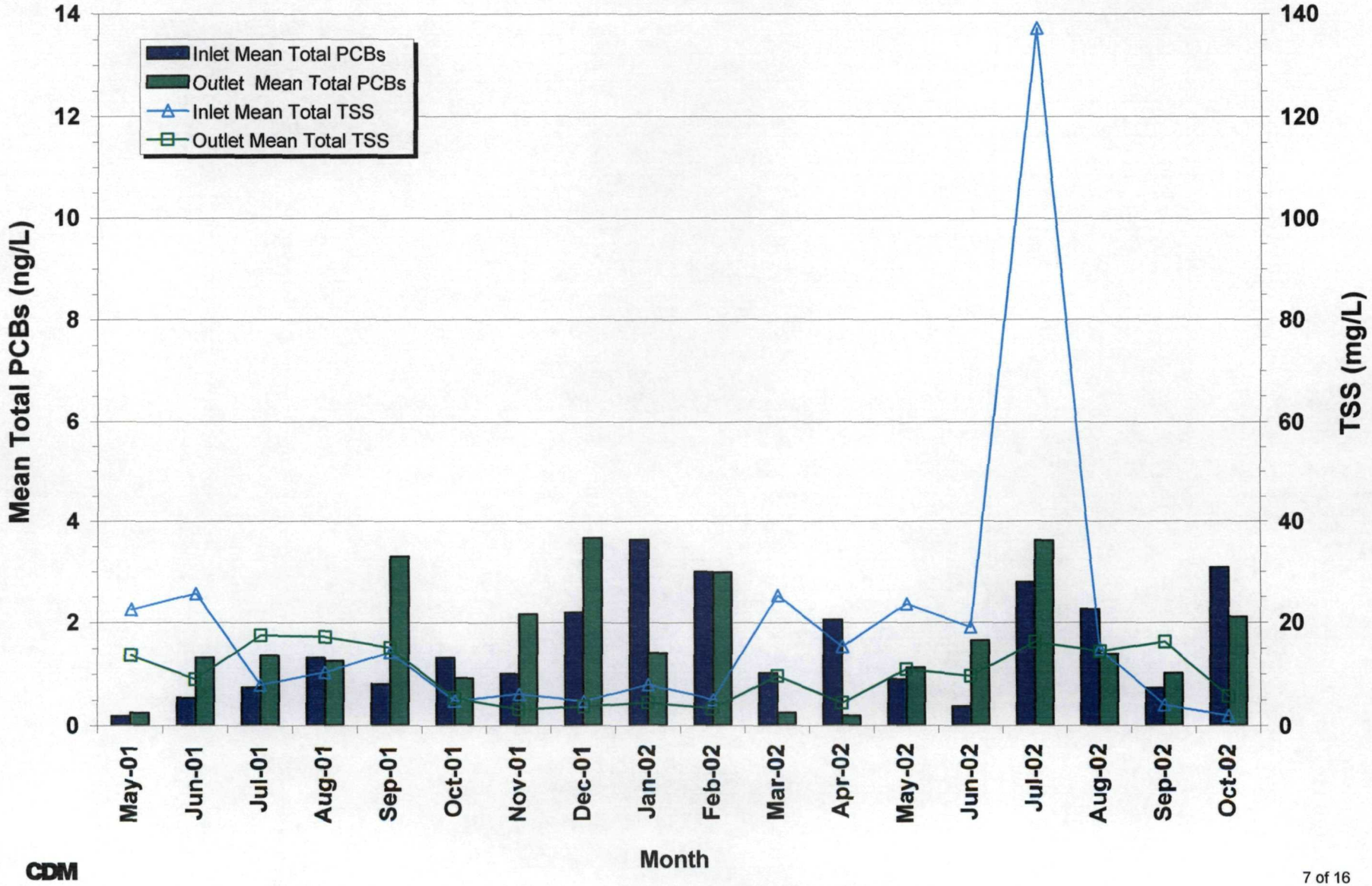
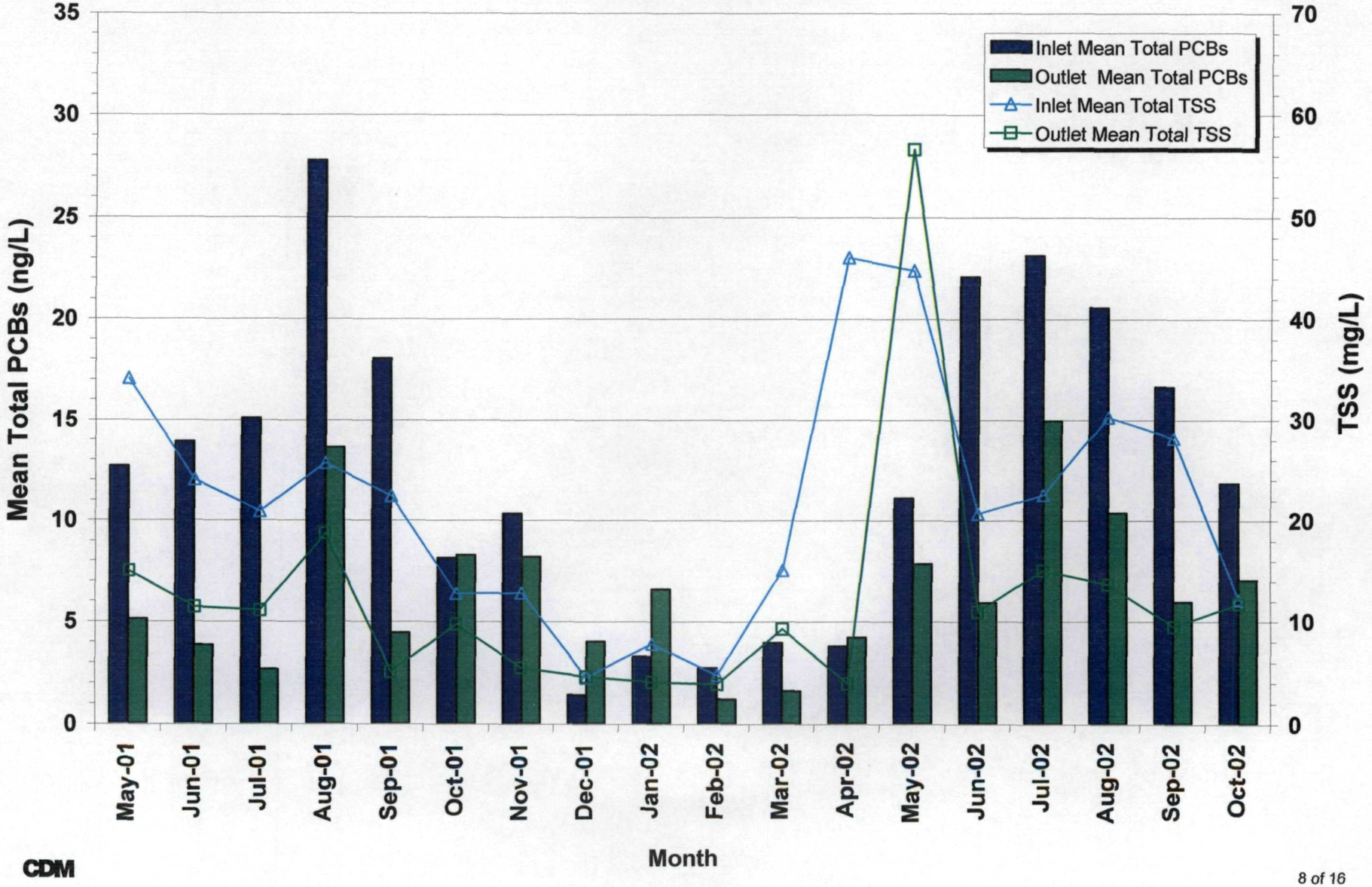


CDM

Figure 3-6. Mean Total PCB and Mean Total TSS Concentrations
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



CDM

Figure 3-7. Mean Total PCB Concentrations and Kalamazoo River Flow
Morrow Lake Inlet - Outlet Stations
May 2001 through October 2002

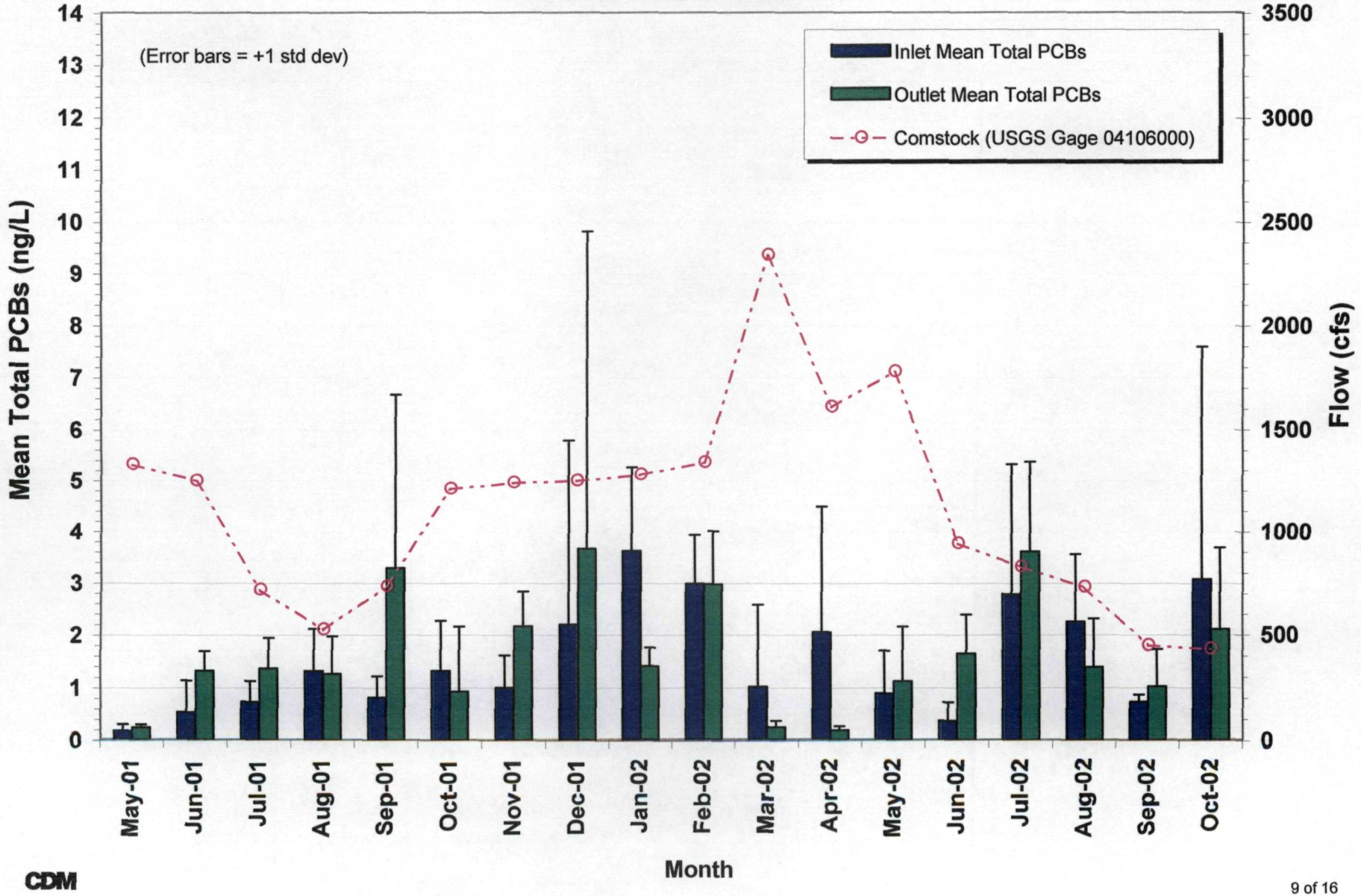


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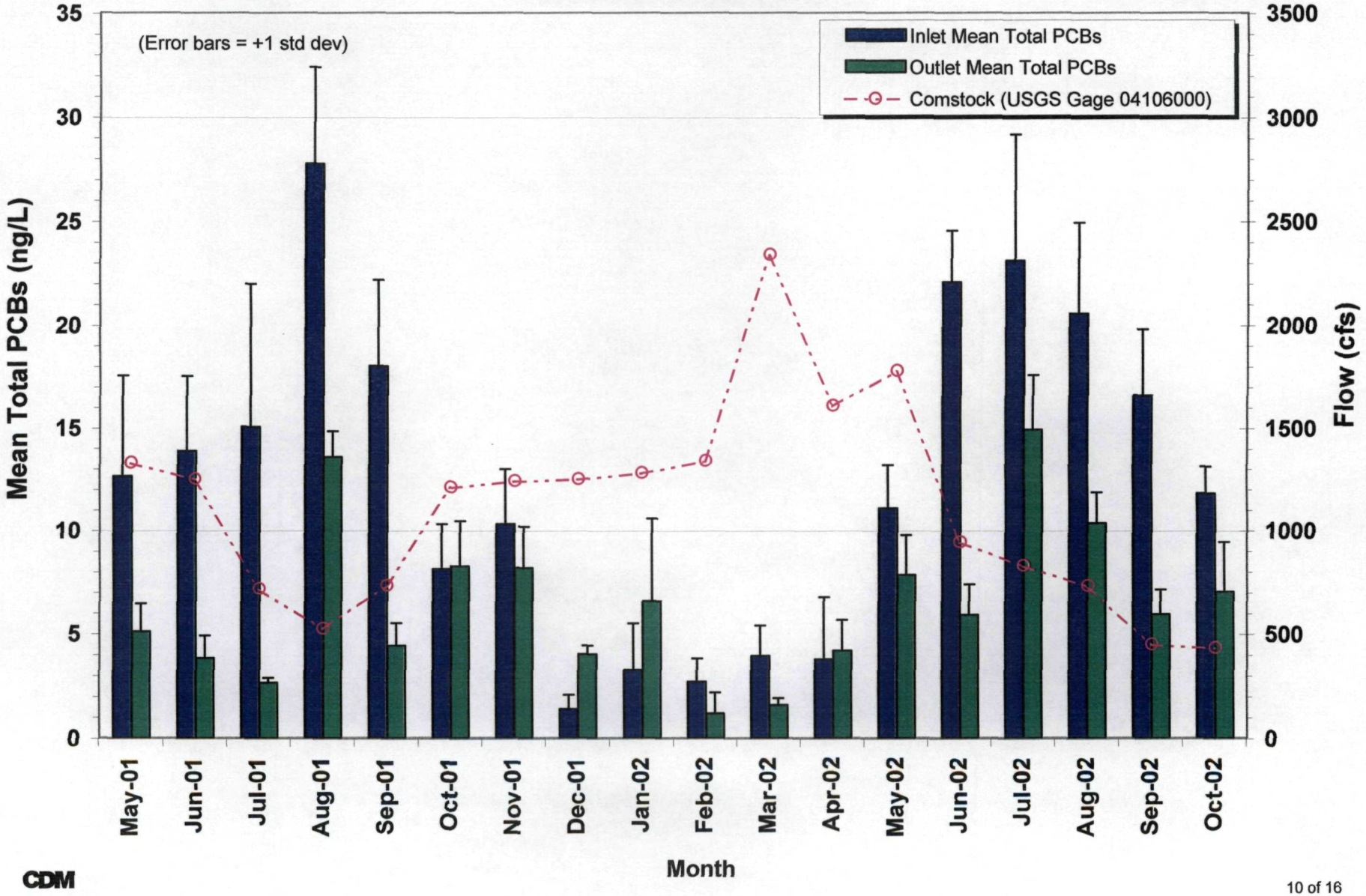
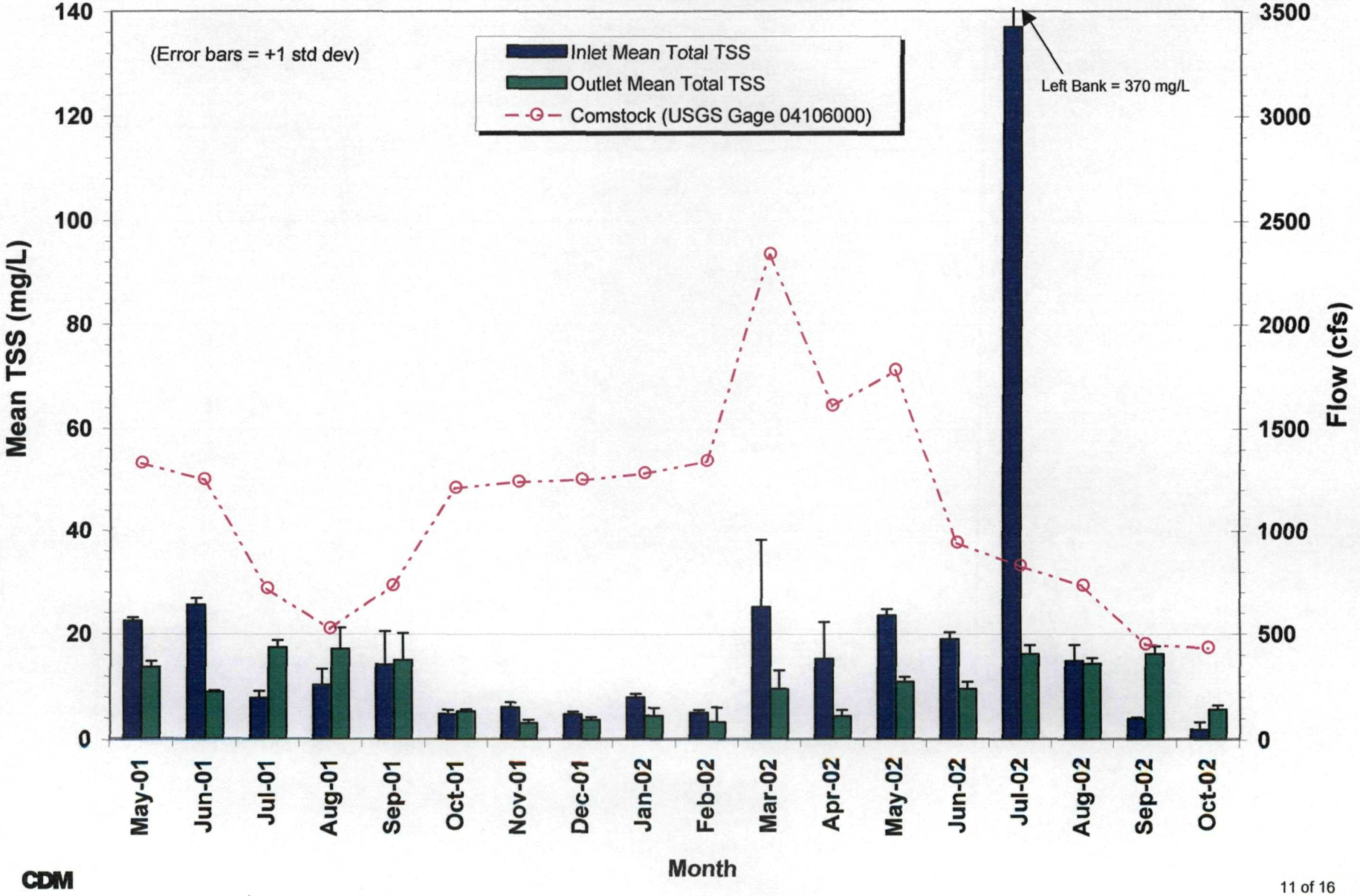
Figure 3-8. Mean Total PCB Concentrations and Kalamazoo River Flow
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



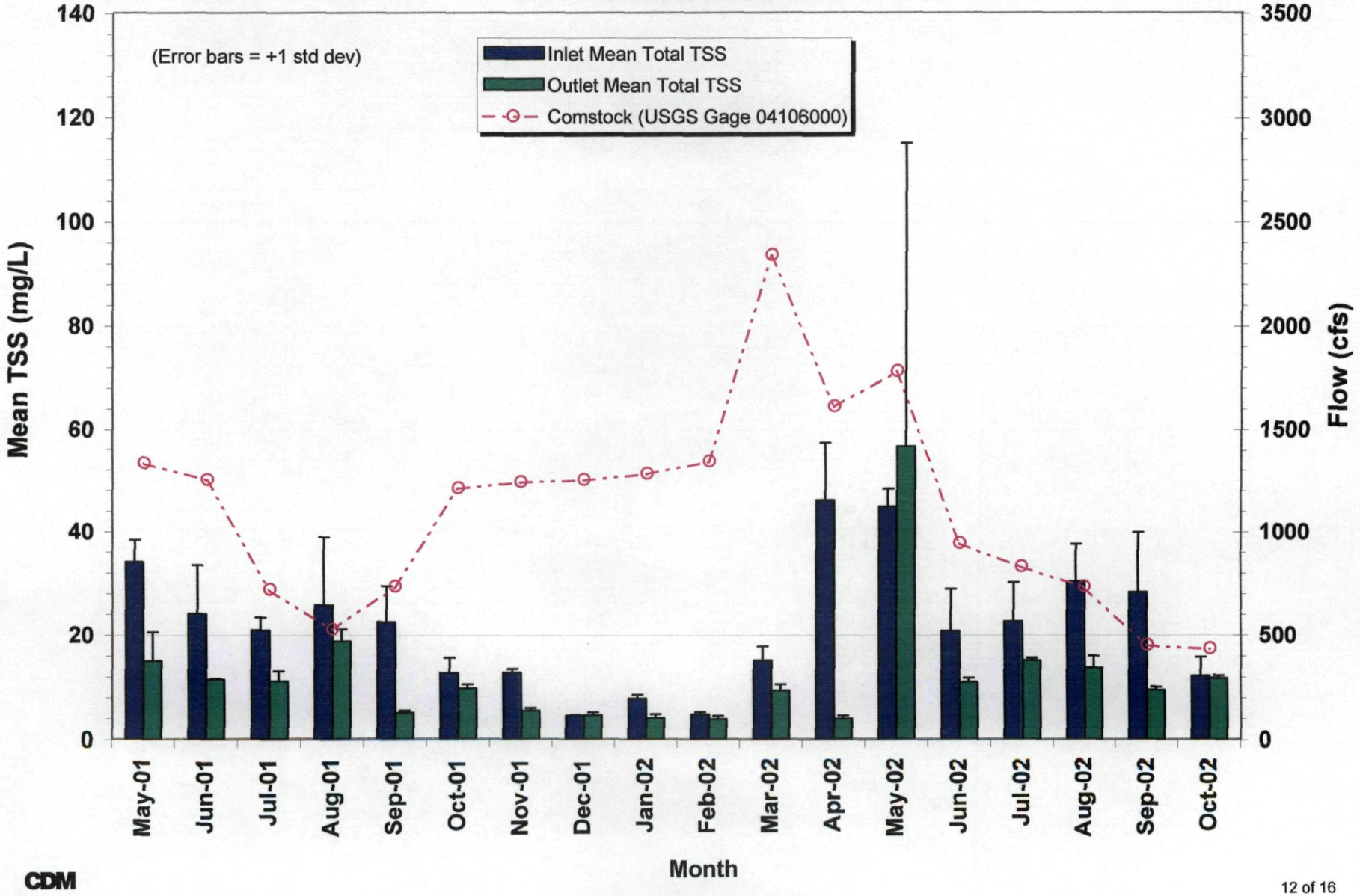
CDM

Figure 3-9. Mean Total TSS Concentrations and Kalamazoo River Flow
Morrow Lake Inlet - Outlet Stations
May 2001 through October 2002



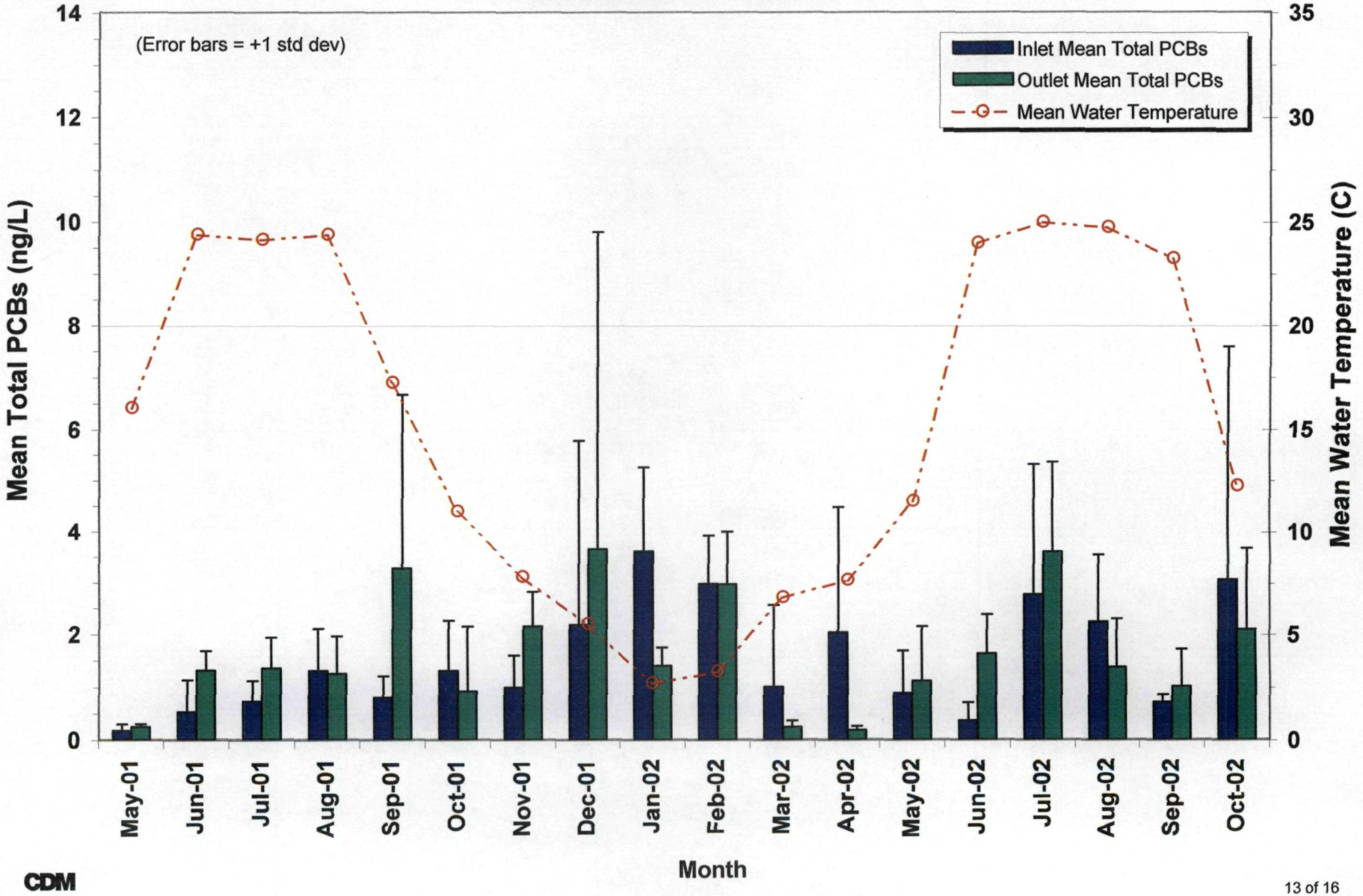
CDM

Figure 3-10. Mean Total TSS Concentrations and Kalamazoo River Flow
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



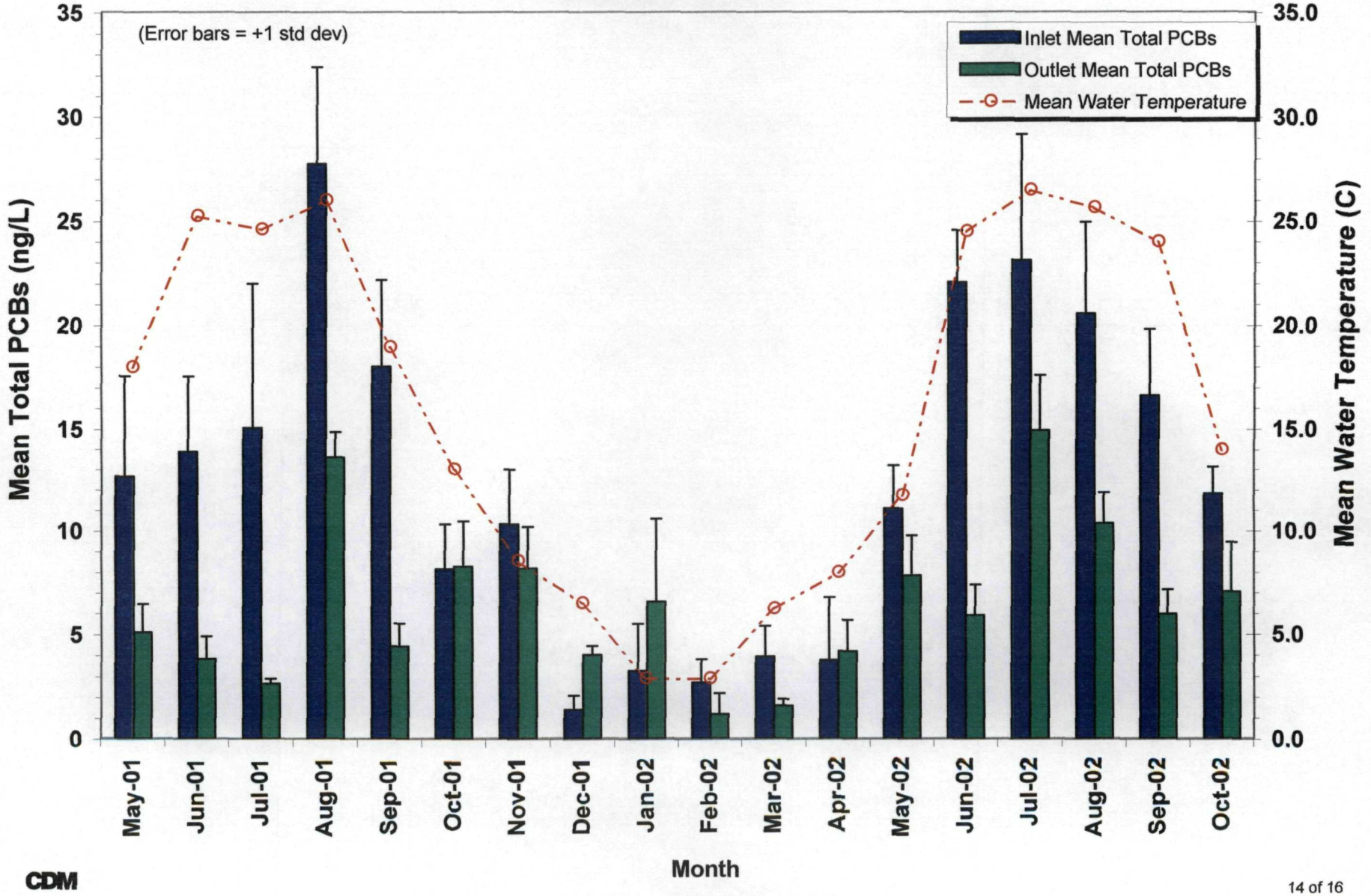
CDM

Figure 3-11. Mean Total PCB Concentrations and Mean Water Temperature
Morrow Lake Inlet - Outlet Stations
May 2001 through October 2002



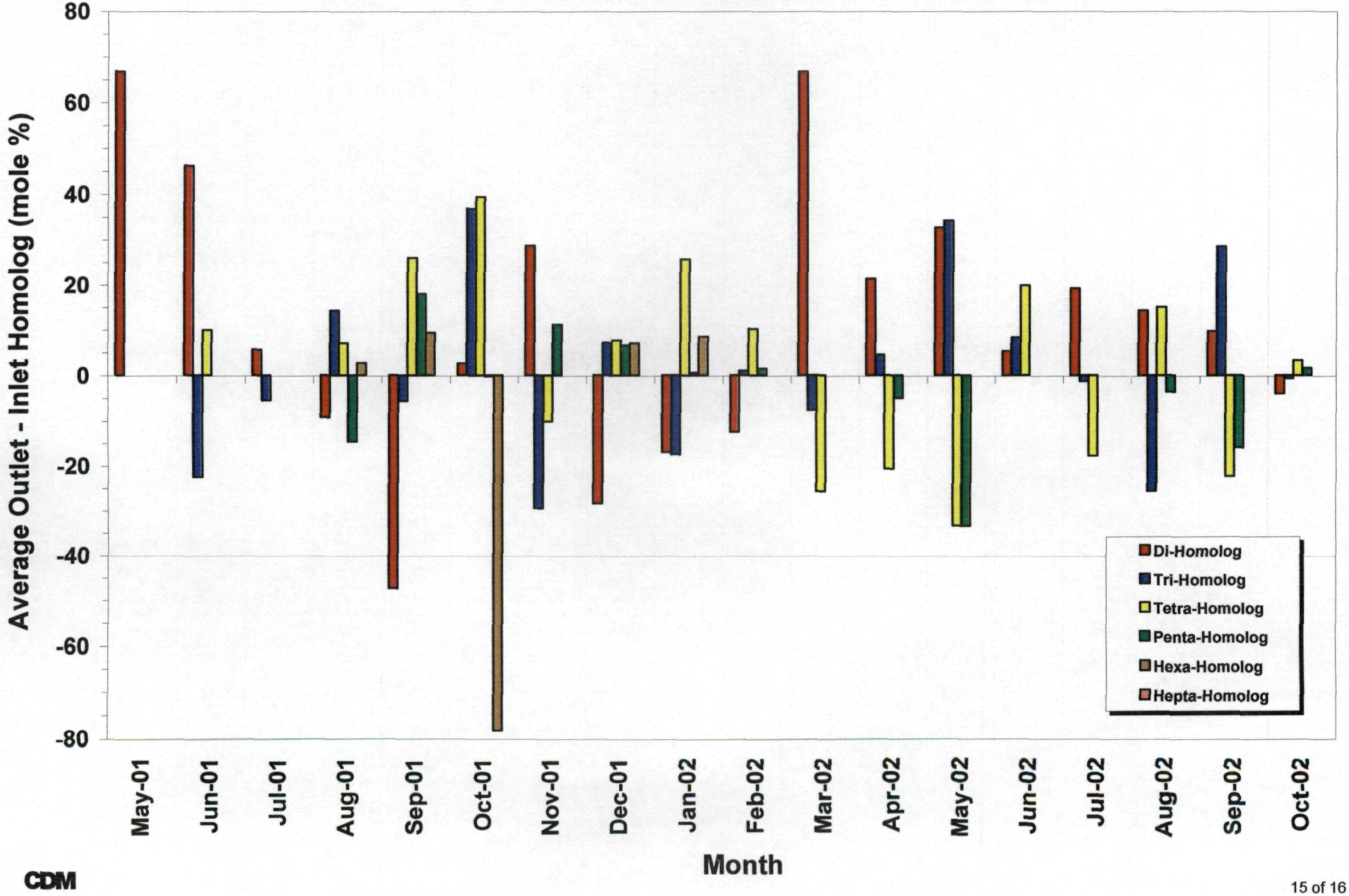
CDM

Figure 3-12. Mean Total PCB Concentrations and Mean Water Temperature
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



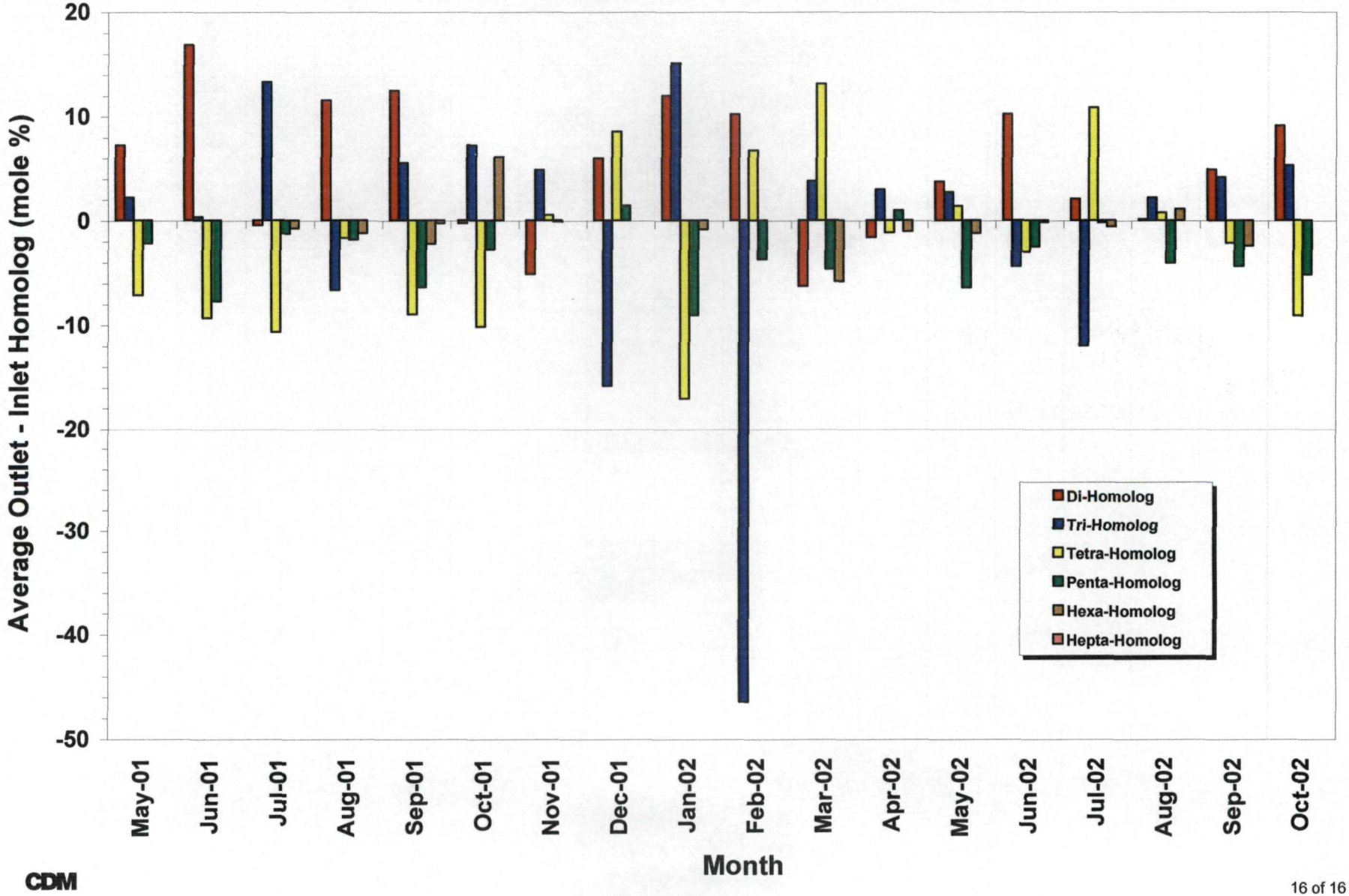
CDM

Figure 3-13. Average PCB Congener Homologs (Mole %)
Morrow Lake Inlet - Outlet Stations
May 2001 through October 2002



CDM

Figure 3-14. Average PCB Congener Homologs (Mole %)
Lake Allegan Inlet - Outlet Stations
May 2001 through October 2002



CDM

Appendix B - Tables

Table 3-1
Total PCB Concentrations (Congeners) in 2001 and 2002
Station 012 - 35th Street Bridge, at Morrow Lake

SampleID[1] (ordered from Left to Right bank)	Date	Total PCBs (ng/L)			Mean Total PCBs (ng/L)[2]	Standard Deviation (ng/L)[2]	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River							
IO-012-1-01 to IO-012-3-01	May 15, 2001	< 0.20	0.31	< 0.20	0.17	0.12	72
IO-012-1-01 to IO-012-3-01	June 14, 2001	0.27	< 0.20	1.21	0.53	0.60	114
IO-012-1-01 to IO-012-3-01	July 11, 2001	0.55	0.45	1.17	0.73	0.39	54
IO-012-1-01 to IO-012-3-01	August 13, 2001	2.17	1.16	0.59	1.30	0.80	61
IO-012-1-01 to IO-012-3-01	September 17, 2001	0.55	1.27	0.58	0.80	0.41	51
IO-012-1-01 to IO-012-3-01	October 9, 2001	0.76	0.75	2.40	1.30	0.95	73
IO-012-1-01 to IO-012-3-01	November 14, 2001	0.70	0.58	1.69	0.99	0.61	62
IO-012-1-01 to IO-012-3-01	December 10, 2001	< 0.20	6.34	< 0.20	2.18	3.60	165
IO-012-1-01 to IO-012-3-01	January 15, 2002	3.20	5.42	2.22	3.61	1.64	45
IO-012-1-01 to IO-012-3-01	February 12, 2002	3.48	3.56	1.89	2.98	0.94	32
IO-012-1-01 to IO-012-3-01	March 14, 2002	2.80	< 0.20	< 0.20	1.00	1.56	156
IO-012-1-01 to IO-012-3-01	April 9, 2002	1.22	< 0.20	4.77	2.03	2.44	120
IO-012-1-01 to IO-012-3-01	May 13, 2002	< 0.20	1.70	0.84	0.88	0.80	91
IO-012-1-01 to IO-012-3-01	June 11, 2002	< 0.20	0.75	0.24	0.36	0.34	95
IO-012-1-01 to IO-012-3-01	July 10, 2002	1.19	1.42	5.70	2.77	2.54	92
IO-012-1-01 to IO-012-3-01	August 14, 2002	1.62	1.35	3.74	2.24	1.31	59
IO-012-1-01 to IO-012-3-01	September 11, 2002	0.76	0.56	0.83	0.72	0.14	19
IO-012-1-01 to IO-012-3-01	October 14, 2002	8.28	0.62	0.29	3.06	4.52	148
						Mean RSD	84

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet-Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit.
Detection Limit=0.20)

Table 3-2
TSS Concentrations in 2001 and 2002
Station 012 - 35th Street Bridge, at Morrow Lake

SampleID[1] (ordered from Left to Right bank)	Location	TSS (mg/L)			Mean TSS[2] (mg/L)	Standard Deviation[2] (mg/L)	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River and Portage Creek							
IO-012-1-01 to IO-012-3-01	May 15, 2001	22.6	21.6	22.8	22.33	0.64	3
IO-012-1-01 to IO-012-3-01	June 14, 2001	26.6	25.6	24.2	25.47	1.21	5
IO-012-1-01 to IO-012-3-01	July 11, 2001	7.8	9.0	6.4	7.73	1.30	17
IO-012-1-01 to IO-012-3-01	August 13, 2001	13.2	10.3	7.2	10.22	3.02	29
IO-012-1-01 to IO-012-3-01	September 17, 2001	9.8	21.4	11.0	14.07	6.38	45
IO-012-1-01 to IO-012-3-01	October 9, 2001	4.2	4.2	5.6	4.67	0.81	17
IO-012-1-01 to IO-012-3-01	November 14, 2001	6.4	6.6	5.0	6.00	0.87	15
IO-012-1-01 to IO-012-3-01	December 10, 2001	4.4	4.2	5.2	4.60	0.53	12
IO-012-1-01 to IO-012-3-01	January 15, 2002	7.4	8.6	7.4	7.80	0.69	9
IO-012-1-01 to IO-012-3-01	February 12, 2002	5.0	4.4	5.4	4.93	0.50	10
IO-012-1-01 to IO-012-3-01	March 14, 2002	23.6	38.8	12.8	25.07	13.06	52
IO-012-1-01 to IO-012-3-01	April 9, 2002	23.2	10.8	11.4	15.13	6.99	46
IO-012-1-01 to IO-012-3-01	May 13, 2002	24.6	23.4	22.2	23.40	1.20	5
IO-012-1-01 to IO-012-3-01	June 11, 2002	18.8	20.2	17.6	18.87	1.30	7
IO-012-1-01 to IO-012-3-01	July 10, 2002	370.0	23.8	17.2	137.00	201.81	147
IO-012-1-01 to IO-012-3-01	August 14, 2002	18.0	14.2	12.0	14.73	3.04	21
IO-012-1-01 to IO-012-3-01	September 11, 2002	4.0	3.6	4.0	3.87	0.23	6
IO-012-1-01 to IO-012-3-01	October 14, 2002	2.0	2.0	3.4	1.80	1.39	77
						Mean RSD	29

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit. (Detection Limit=2)

Table 3-3
Total PCB Concentrations (Congeners) in 2001 and 2002
Station 013 - River Road Bridge, Near Comstock

SampleID[1] (ordered from Left to Right bank)	Date	Total PCBs (ng/L)			Mean Total PCBs (ng/L)[2]	Standard Deviation (ng/L)[2]	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River							
IO-013-1-01 to IO-013-3-01	May 15, 2001	0.21	0.30	< 0.20	0.21	0.10	49
IO-013-1-01 to IO-013-3-01	June 14, 2001	0.90	1.42	1.61	1.31	0.37	28
IO-013-1-01 to IO-013-3-01	July 11, 2001	1.31	1.95	0.79	1.35	0.58	43
IO-013-1-01 to IO-013-3-01	August 13, 2001	0.84	0.84	2.07	1.25	0.71	57
IO-013-1-01 to IO-013-3-01	September 17, 2001	0.43	7.02	2.39	3.28	3.38	103
IO-013-1-01 to IO-013-3-01	October 9, 2001	2.33	< 0.20	< 0.20	0.84	1.29	153
IO-013-1-01 to IO-013-3-01	November 14, 2001	2.72	1.42	2.30	2.15	0.67	31
IO-013-1-01 to IO-013-3-01	December 10, 2001	10.75	< 0.20	< 0.20	3.65	6.15	168
IO-013-1-01 to IO-013-3-01	January 15, 2002	1.65	1.54	1.00	1.40	0.35	25
IO-013-1-01 to IO-013-3-01	February 12, 2002	2.96	1.94	4.00	2.97	1.03	35
IO-013-1-01 to IO-013-3-01	March 14, 2002	0.33	< 0.20	0.28	0.24	0.12	52
IO-013-1-01 to IO-013-3-01	April 9, 2002	0.22	< 0.20	0.23	0.18	0.07	40
IO-013-1-01 to IO-013-3-01	May 13, 2002	< 0.20	1.07	2.16	1.11	1.03	93
IO-013-1-01 to IO-013-3-01	June 11, 2002	0.86	1.68	2.35	1.63	0.74	46
IO-013-1-01 to IO-013-3-01	July 10, 2002	5.22	1.74	3.85	3.60	1.75	49
IO-013-1-01 to IO-013-3-01	August 14, 2002	0.97	2.43	0.72	1.37	0.92	67
IO-013-1-01 to IO-013-3-01	September 11, 2002	0.54	0.66	1.82	1.01	0.71	70
IO-013-1-01 to IO-013-3-01	October 14, 2002	0.27	2.83	3.17	2.09	1.59	76
						Mean RSD	66

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet-Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit.
Detection Limit=0.20)

Table 3-4
TSS Concentrations in 2001 and 2002
Station 013 - River Road Bridge, Near Comstock

SampleID[1] (ordered from Left to Right bank)	Location	TSS (mg/L)			Mean TSS[2] (mg/L)	Standard Deviation[2] (mg/L)	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River and Portage Creek							
IO-013-1-01 to IO-013-3-01	May 15, 2001	14.8	12.6	13.2	13.53	1.14	8
IO-013-1-01 to IO-013-3-01	June 14, 2001	9.0	9.0	8.6	8.87	0.23	3
IO-013-1-01 to IO-013-3-01	July 11, 2001	16.2	17.0	18.8	17.33	1.33	8
IO-013-1-01 to IO-013-3-01	August 13, 2001	19.8	12.4	18.9	17.03	4.04	24
IO-013-1-01 to IO-013-3-01	September 17, 2001	12.2	20.8	11.8	14.93	5.08	34
IO-013-1-01 to IO-013-3-01	October 9, 2001	5.6	5.0	5.0	5.20	0.35	7
IO-013-1-01 to IO-013-3-01	November 14, 2001	3.6	3.0	2.4	3.00	0.60	20
IO-013-1-01 to IO-013-3-01	December 10, 2001	4.2	3.4	3.2	3.60	0.53	15
IO-013-1-01 to IO-013-3-01	January 15, 2002	6.0	3.2	3.8	4.33	1.47	34
IO-013-1-01 to IO-013-3-01	February 12, 2002	6.2	2.4	2.0	3.20	2.69	84
IO-013-1-01 to IO-013-3-01	March 14, 2002	8.8	6.4	13.2	9.47	3.45	36
IO-013-1-01 to IO-013-3-01	April 9, 2002	3.4	3.8	5.6	4.27	1.17	27
IO-013-1-01 to IO-013-3-01	May 13, 2002	11.6	9.8	11.0	10.80	0.92	8
IO-013-1-01 to IO-013-3-01	June 11, 2002	11.0	8.6	8.8	9.47	1.33	14
IO-013-1-01 to IO-013-3-01	July 10, 2002	15.9	17.8	14.5	16.07	1.66	10
IO-013-1-01 to IO-013-3-01	August 14, 2002	13.0	15.0	14.6	14.20	1.06	7
IO-013-1-01 to IO-013-3-01	September 11, 2002	17.0	16.8	14.4	16.07	1.45	9
IO-013-1-01 to IO-013-3-01	October 14, 2002	5.4	6.4	4.8	5.53	0.81	15
						Mean RSD	20

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit. (Detection Limit=2)

Table 3-5
Total PCB Concentrations (Congeners) in 2001 and 2002
Station 027 - Middle of M-89 Bridge at Lake Allegan Inlet

SampleID[1] (ordered from Left to Right bank)	Date	Total PCBs (ng/L)			Mean Total PCBs (ng/L)[2]	Standard Deviation (ng/L)[2]	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River							
IO-027-1-01 to IO-027-3-01	May 15, 2001	17.64	12.42	7.84	12.63	4.90	39
IO-027-1-01 to IO-027-3-01	June 14, 2001	13.90	17.50	10.17	13.85	3.67	26
IO-027-1-01 to IO-027-3-01	July 11, 2001	23.04	11.11	10.97	15.04	6.93	46
IO-027-1-01 to IO-027-3-01	August 13, 2001	32.98	26.10	24.11	27.73	4.66	17
IO-027-1-01 to IO-027-3-01	September 17, 2001	21.80	13.58	18.64	18.01	4.15	23
IO-027-1-01 to IO-027-3-01	October 9, 2001	10.35	5.99	7.97	8.11	2.18	27
IO-027-1-01 to IO-027-3-01	November 14, 2001	9.57	13.26	8.06	10.29	2.68	26
IO-027-1-01 to IO-027-3-01	December 10, 2001	1.83	1.71	0.61	1.38	0.67	48
IO-027-1-01 to IO-027-3-01	January 15, 2002	1.64	5.79	2.30	3.24	2.23	69
IO-027-1-01 to IO-027-3-01	February 12, 2002	1.62	3.84	2.60	2.69	1.11	41
IO-027-1-01 to IO-027-3-01	March 14, 2002	2.71	5.52	3.53	3.92	1.45	37
IO-027-1-01 to IO-027-3-01	April 9, 2002	7.09	2.90	1.28	3.76	3.00	80
IO-027-1-01 to IO-027-3-01	May 13, 2002	12.75	11.72	8.71	11.06	2.10	19
IO-027-1-01 to IO-027-3-01	June 11, 2002	24.73	21.58	19.83	22.05	2.48	11
IO-027-1-01 to IO-027-3-01	July 10, 2002	26.78	26.42	16.09	23.10	6.07	26
IO-027-1-01 to IO-027-3-01	August 14, 2002	25.22	16.57	19.84	20.54	4.37	21
IO-027-1-01 to IO-027-3-01	September 11, 2002	18.66	18.20	12.92	16.60	3.19	19
IO-027-1-01 to IO-027-3-01	October 14, 2002	12.93	12.07	10.37	11.79	1.30	11
						Mean RSD	33

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet-Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit.
(Detection Limit=0.20)

Table 3-6
TSS Concentrations in 2001 and 2002
Station 027 - Middle of M-89 Bridge at Lake Allegan Inlet

SampleID[1] (ordered from Left to Right bank)	Location	TSS (mg/L)			Mean TSS[2] (mg/L)	Standard Deviation[2] (mg/L)	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River and Portage Creek							
IO-027-1-01 to IO-027-3-01	May 15, 2001	38.1	34.3	29.6	34.00	4.26	13
IO-027-1-01 to IO-027-3-01	June 14, 2001	34.6	20.2	17.0	23.93	9.38	39
IO-027-1-01 to IO-027-3-01	July 11, 2001	22.4	18.0	22.0	20.80	2.43	12
IO-027-1-01 to IO-027-3-01	August 13, 2001	33.8	32.6	10.4	25.60	13.18	51
IO-027-1-01 to IO-027-3-01	September 17, 2001	30.4	18.0	18.6	22.33	6.99	31
IO-027-1-01 to IO-027-3-01	October 9, 2001	16.0	11.2	10.8	12.67	2.89	23
IO-027-1-01 to IO-027-3-01	November 14, 2001	13.4	12.8	12.0	12.73	0.70	6
IO-027-1-01 to IO-027-3-01	December 10, 2001	4.4	4.6	4.4	4.47	0.12	3
IO-027-1-01 to IO-027-3-01	January 15, 2002	7.4	8.6	7.2	7.73	0.76	10
IO-027-1-01 to IO-027-3-01	February 12, 2002	4.2	5.2	4.6	4.67	0.50	11
IO-027-1-01 to IO-027-3-01	March 14, 2002	12.0	17.2	15.8	15.00	2.69	18
IO-027-1-01 to IO-027-3-01	April 9, 2002	57.7	45.2	35.0	45.97	11.37	25
IO-027-1-01 to IO-027-3-01	May 13, 2002	45.0	48.0	41.1	44.70	3.46	8
IO-027-1-01 to IO-027-3-01	June 11, 2002	30.0	16.2	15.6	20.60	8.15	40
IO-027-1-01 to IO-027-3-01	July 10, 2002	30.6	21.1	15.7	22.47	7.54	34
IO-027-1-01 to IO-027-3-01	August 14, 2002	38.4	27.8	24.4	30.20	7.30	24
IO-027-1-01 to IO-027-3-01	September 11, 2002	41.4	19.4	23.6	28.13	11.68	42
IO-027-1-01 to IO-027-3-01	October 14, 2002	16.2	9.8	10.2	12.07	3.59	30
						Mean RSD	23

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit. (Detection Limit=2)

Table 3-7
Total PCB Concentrations (Congeners) in 2001 and 2002
Station 071 - Calkins Dam, u/s of Turbine Influent Channels

SampleID[1] (ordered from Left to Right bank)	Date	Total PCBs (ng/L)			Mean Total PCBs (ng/L)[2]	Standard Deviation (ng/L)[2]	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River							
IO-071-1-01 to IO-071-3-01	May 15, 2001	5.25	6.34	3.65	5.08	1.35	27
IO-071-1-01 to IO-071-3-01	June 14, 2001	2.60	4.17	4.66	3.81	1.08	28
IO-071-1-01 to IO-071-3-01	July 11, 2001	2.52	2.48	2.90	2.63	0.23	9
IO-071-1-01 to IO-071-3-01	August 13, 2001	14.99	13.10	12.61	13.57	1.26	9
IO-071-1-01 to IO-071-3-01	September 17, 2001	3.96	5.64	3.62	4.41	1.08	25
IO-071-1-01 to IO-071-3-01	October 9, 2001	5.72	9.37	9.66	8.25	2.20	27
IO-071-1-01 to IO-071-3-01	November 14, 2001	6.09	8.26	10.12	8.16	2.02	25
IO-071-1-01 to IO-071-3-01	December 10, 2001	4.26	3.50	4.22	3.99	0.43	11
IO-071-1-01 to IO-071-3-01	January 15, 2002	11.11	4.99	3.59	6.56	4.00	61
IO-071-1-01 to IO-071-3-01	February 12, 2002	1.37	2.05	< 0.20	1.17	0.99	84
IO-071-1-01 to IO-071-3-01	March 14, 2002	1.29	1.91	1.54	1.58	0.32	20
IO-071-1-01 to IO-071-3-01	April 9, 2002	5.87	3.16	3.49	4.17	1.48	35
IO-071-1-01 to IO-071-3-01	May 13, 2002	10.05	6.91	6.51	7.82	1.94	25
IO-071-1-01 to IO-071-3-01	June 11, 2002	7.61	5.01	5.05	5.89	1.49	25
IO-071-1-01 to IO-071-3-01	July 10, 2002	15.35	12.08	17.33	14.92	2.65	18
IO-071-1-01 to IO-071-3-01	August 14, 2002	9.22	12.05	9.76	10.34	1.51	15
IO-071-1-01 to IO-071-3-01	September 11, 2002	4.60	6.85	6.38	5.94	1.19	20
IO-071-1-01 to IO-071-3-01	October 14, 2002	5.41	9.78	5.87	7.02	2.40	34
						Mean RSD	28

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet-Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit. (Detection Limit=0.20)

Table 3-8
TSS Concentrations in 2001 and 2002
Station 071 - Calkins Dam, u/s of Turbine Influent Channels

SampleID[1] (ordered from Left to Right bank)	Location	TSS (mg/L)			Mean TSS[2] (mg/L)	Standard Deviation[2] (mg/L)	Relative Standard Deviation (%)
		Left Bank	Mid-Channel	Right Bank			
Kalamazoo River and Portage Creek							
IO-071-1-01 to IO-071-3-01	May 15, 2001	11.4	21.2	12.2	14.93	5.44	36
IO-071-1-01 to IO-071-3-01	June 14, 2001	11.2	11.4	11.4	11.33	0.12	1
IO-071-1-01 to IO-071-3-01	July 11, 2001	11.6	8.8	12.6	11.00	1.97	18
IO-071-1-01 to IO-071-3-01	August 13, 2001	17.0	17.6	21.3	18.63	2.33	12
IO-071-1-01 to IO-071-3-01	September 17, 2001	4.6	5.0	5.4	5.00	0.40	8
IO-071-1-01 to IO-071-3-01	October 9, 2001	9.8	8.8	10.4	9.67	0.81	8
IO-071-1-01 to IO-071-3-01	November 14, 2001	6.0	5.2	5.0	5.40	0.53	10
IO-071-1-01 to IO-071-3-01	December 10, 2001	4.2	5.2	4.2	4.53	0.58	13
IO-071-1-01 to IO-071-3-01	January 15, 2002	4.2	4.6	3.2	4.00	0.72	18
IO-071-1-01 to IO-071-3-01	February 12, 2002	4.4	3.8	3.2	3.80	0.60	16
IO-071-1-01 to IO-071-3-01	March 14, 2002	8.6	10.6	8.4	9.20	1.22	13
IO-071-1-01 to IO-071-3-01	April 9, 2002	4.2	4.2	3.2	3.87	0.58	15
IO-071-1-01 to IO-071-3-01	May 13, 2002	25.7	124.0	20.0	56.57	58.47	103
IO-071-1-01 to IO-071-3-01	June 11, 2002	11.6	11.0	10.0	10.87	0.81	7
IO-071-1-01 to IO-071-3-01	July 10, 2002	14.8	15.5	14.7	15.00	0.44	3
IO-071-1-01 to IO-071-3-01	August 14, 2002	11.0	14.6	15.2	13.60	2.27	17
IO-071-1-01 to IO-071-3-01	September 11, 2002	8.8	9.4	10.0	9.40	0.60	6
IO-071-1-01 to IO-071-3-01	October 14, 2002	11.6	11.2	12.2	11.67	0.50	4
						Mean RSD	17

Notes:

1. SampleID uses a 4-part nomenclature, in the following format: AA-BB-C-DD. AA is Matrix type (IO-Inlet Outlet); BBB is the sampling station identification number; C is location on transect (looking downstream, where 1 is Left Bank, 2 is Mid-Channel, and 3 is Right Bank; and DD is sample type (01-first or original sample, 02-blank, 03-duplicate)
2. Value used for non-detects in statistical analyses was one-half of the detection limit. (Detection Limit=2)

Table 3-9
Daily Mean Kalamazoo River Flows During May 2001 through October 2002
Inlet - Outlet Surface Water Sampling Surveys

Date	Kalamazoo River at Comstock (USGS Gage 04106000)	Kalamazoo River near Allegan (USGS Gage 04107850)	Lake Allegan Dam (Consumers Power)
May 15, 2001	1330	-	-
June 14, 2001	1250	2150	-
July 11, 2001	717	1019	867
August 13, 2001	525	863	760
September 17, 2001	733	1030	867
October 9, 2001	1210	1840	-
November 14, 2001	1240	1930	1612
December 10, 2001	1250	1850	1430
January 15, 2002	1280	2220	1974
February 12, 2002	1340	2120	2165
March 14, 2002	2340	3650	3685
April 9, 2002	1610	3070	2865
May 13, 2002	1780	3320	3435
June 11, 2002	943	1680	1477
July 10, 2002	830	1280	837
August 14, 2002	732	1000	867
September 11, 2002	450	763	745
October 14, 2002	433	898	745

Table 3-10
Summary of Average PCB, TSS, Water Temperature, Flow Data By Season
Morrow Lake and Lake Allegan - May 2001 to October 2002

Morrow Lake							
Season[1]	**Mean Total PCB[2] (ng/L)**		**Mean Total TSS[2] (mg/L)**		**Mean Water Temperature (°C)**		**Mean Flow (cfs)**
	Inlet	*Outlet*	*Inlet*	*Outlet*	*Inlet*	*Outlet*	*Comstock (USGS Gage 04106000)*
Spring (n=4)	1.02	0.43	21.48	9.52	10.3	10.7	1765
Summer (n=6)	1.32	1.75	35.67	13.83	23.7	25.3	833
Fall (n=5)	1.37	1.87	6.08	8.95	13.6	15.0	800
Winter (n=3)	2.92	2.67	5.78	3.71	3.9	3.7	1290

Lake Allegan							
Season[1]	**Mean Total PCB[2] (ng/L)**		**Mean Total TSS[2] (mg/L)**		**Mean Water Temperature (°C)**		**Mean Flow (cfs)**
	Inlet	*Outlet*	*Inlet*	*Outlet*	*Inlet*	*Outlet*	*Comstock (USGS Gage 04106000)*
Spring (n=4)	7.84	4.66	34.92	21.14	10.9	11.1	1765
Summer (n=6)	20.38	8.53	23.93	13.41	24.7	26.2	833
Fall (n=5)	12.96	6.76	17.59	8.23	15.2	16.2	800
Winter (n=3)	2.44	3.91	5.62	4.11	4.3	3.9	1290

Notes:

1. Seasons are Spring (March-May), Summer (June-August), Fall (September-November), and Winter (December-February), with "n" indicating sample size.
2. Value used for non-detects in statistical analyses was one-half of the detection limit.
(Detection Limit=0.20)

Table 3-11
Daily Mean Total PCB Loading during the 2001 and 2002
Inlet - Outlet Surface Water Sampling Events

Date	Morrow Lake		Lake Allegan	
	Inlet (lbs/day)	Outlet (lbs/day)	Inlet (lbs/day)	Outlet (lbs/day)
May 15, 2001	0.001	0.001	-	-
June 14, 2001	0.004	0.009	0.160	0.012
July 11, 2001	0.003	0.005	0.082	0.001
August 13, 2001	0.004	0.004	0.129	0.006
September 17, 2001	0.003	0.013	0.100	0.006
October 9, 2001	0.008	0.005	0.080	0.022
November 14, 2001	0.007	0.014	0.107	0.021
December 10, 2001	0.015	0.025	0.014	0.004
January 15, 2002	0.025	0.010	0.039	0.048
February 12, 2002	0.021	0.021	0.031	0.011
March 14, 2002	0.013	0.003	0.077	0.006
April 9, 2002	0.018	0.002	0.062	0.024
May 13, 2002	0.008	0.011	0.198	0.035
June 11, 2002	0.002	0.008	0.199	0.013
July 10, 2002	0.012	0.016	0.159	0.018
August 14, 2002	0.009	0.005	0.111	0.008
September 11, 2002	0.007	0.005	0.048	0.010

DAILY LOADING

MAXIMUM (lbs/day)	*0.025*	*0.025*	*0.199*	*0.048*
MINIMUM (lbs/day)	*0.001*	*0.001*	*0.014*	*0.001*
AVERAGE (lbs/day)	*0.009*	*0.009*	*0.100*	*0.015*

Table 3-12
Laboratory Quality Control
Inlet - Outlet Surface Water Sampling Surveys

Date	Met QC Criteria[1] (Yes/No)	QC Explanation	Data Usable (Yes/No)
May 15, 2001	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 33% RPD for these medium level samples; however no data were qualified based on this deviation.	Yes
June 14, 2001	Yes	The field duplicate was within the control criteria of 25% RPD for field duplicates at 16% RPD for these medium level samples.	Yes
July 11, 2001	Yes	One sample was re-analyzed due to an internal contamination problem and the re-analysis was successful. The field duplicate was within the control criteria of 25% RPD for field duplicates at 17% RPD for these medium concentration samples.	Yes
August 13, 2001	Yes	The field duplicate was within the control criteria of 25% RPD for field duplicates at 3% RPD for these high concentration samples.	Yes
September 17, 2001	Yes	The field duplicate was within the control criteria of 25% RPD for field duplicates at 10% RPD for these low concentration samples.	Yes
October 9, 2001	Yes	The field duplicate was outside the control criteria of 25% for field duplicates at 118% for these low concentration samples, however no data were qualified based on this deviation. Three of the samples in this batch contained laboratory derived Aroclor 1260 contamination so it was recommended that the data be used without the Aroclor 1260 peaks. Total PCB concentrations were qualified with a "J" for estimated due to this issue.	Yes
November 14, 2001	Yes	The field duplicate was within the control criteria of 25% RPD for field duplicates at 16% RPD for these low concentration samples.	Yes
December 10, 2001	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 122% for these low concentration samples, however no data were qualified based on this deviation.	Yes
January 15, 2002	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 128% for these low concentration samples, however no data were qualified based on this deviation.	Yes
February 12, 2002	Yes	Four of the samples did require re-analysis by the lab due to an internal lab problem however the re-analysis was acceptable. The field duplicate was outside the control criteria of 25% RPD for field duplicates at 48% for these low concentration samples, however no data were qualified based on this deviation.	Yes
March 14, 2002	Yes	The field duplicate was within the control criteria of 25% RPD for field duplicates at 0% RPD as both sample and duplicate were non-detect for PCB congeners.	Yes
April 9, 2002	Yes	The field duplicate was within the control criteria of 25% for field duplicates at 15% RPD for these low concentration samples.	Yes
May 13, 2002	Yes	The field duplicate was within the control criteria of 25% for field duplicates at 13% RPD for these low concentration samples.	Yes
June 11, 2002	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 93% RPD for these low concentration samples; however no data were qualified based on this deviation.	Yes
July 10, 2002	Yes	Both the laboratory and field blank for these samples contained PCB congeners at levels above the MDL but below the PQL so no data qualification was required. Two samples were re-analyzed due to a contamination problem in the auto-sampler. The re-analysis was acceptable. The field duplicate was within the control criteria of 25% RPD for field duplicates at 3% RPD for these medium concentration samples.	Yes
August 14, 2002	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 56% RPD for these low concentration samples; however no data were qualified based on this deviation.	Yes
September 11, 2002	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 53% RPD for these medium concentration samples; however no data were qualified based on this deviation. The sample portion of the field sample/duplicate pair was rerun due to chromatographic interference. The sample rerun was acceptable and was used for reporting and for RPD calculations.	Yes
October 14, 2002	Yes	The field duplicate was outside the control criteria of 25% RPD for field duplicates at 73% RPD for these low concentration samples; however no data were qualified based on this deviation. In both the sample and duplicate, PCB congener detections were near or below the PQL but above the MDL.	Yes

NOTES:

[1] QC criteria includes check standards, laboratory control spikes, laboratory blanks, MS/MSDs and surrogate recoveries.